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Louisville Builds New Pumping Station on Huge Open-Well Caisson

...l Prefilter Pre-... Sand Accretion ...awrence Plant

Setting 25,000 Meters Cut Water Consumption at San Francisco
By GEORGE W. FISKE

Water-Supply at the French Front
By R. K. TOMLIN, JR.
War Correspondent of Engineering News-Record

Electric Operation of Small Pumping Station
By HARRISON B. CADY

Other Articles of Interest to Water-Works Men

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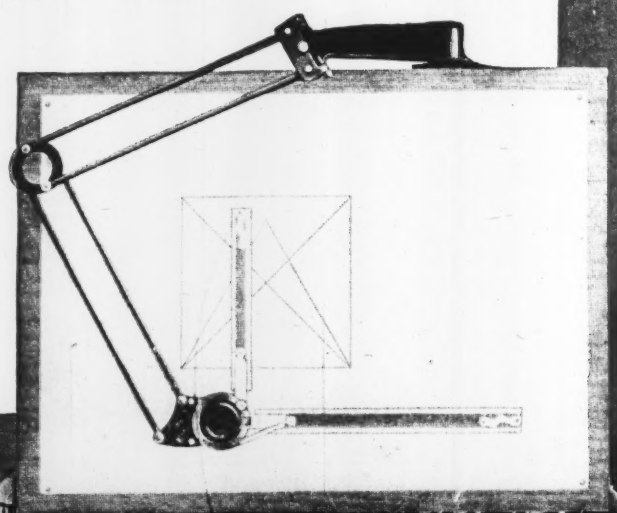

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DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. MEHREN, *Editor* — CHARLES WHITING BAKER, *Consulting Editor*

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Why Water-Works Topics Dominate This Number

WATER-WORKS subjects dominate this issue, in recognition of the convention of the American Water-Works Association at St. Louis next week. An attempt has been made not only to represent the water-works activities of the country, both geographically and by topics, but also to reflect the importance of water-supply in the war by dealing with the methods in use at our home training camps and at the front itself. Nothing is more vital to the country and to the war than adequate and pure water-supplies for cities and soldiers.

Getting Water to the Soldier at the Front

WATER-SUPPLY at the front is graphically pictured on p. 892 by pen and official photographs sent from France by Mr. Tomlin, war correspondent of *Engineering News-Record*. Nothing could be of more timely interest to water-works men. Engineers generally will read the article with eagerness. It is a just tribute to French, British and American engineering science and organization.

Water Conservation in Camp and City

CONSERVATION of water in American army camps was made a basic condition of design by the engineers who planned the cantonments a year ago. How nearly their belief that water waste could be kept to reasonable limits under camp conditions was justified may be judged from Lieutenant Colonel Maury's diagram and comments, on p. 904, on water consumption at 30 camps. The installing of 25,000 water meters in San Francisco, described by Mr. Pracy on p. 902, was a large task systematically handled by the Spring Valley Water Co. On p. 918 appears an article dealing with water-waste control at Oak Park. Those who are fighting against water waste in camp and city are contributing to war efficiency.

Pumping, Purification and Other Topics Important

NUMEROUS problems in water-works design, construction and operation are dealt with in this issue by articles and notes of broad appeal. These include descriptions of the construction of a new pumping station at Louisville; a new water-treatment plant at Lawrence, Kan.; the electrification of a group of pumping stations at Philadelphia; the organization of the pipe-extension division of the Chicago water-works and various improvements carried out by it; and several articles on the water-works of St. Louis, the city where the convention of the American Water-Works Association meets. The range of subjects listed gives some idea of the many problems which confront the water-works engineer and superintendent. The program for the convention next week, which will present still other problems, is one that should insure an attendance fully representative of all grades of membership in the American Water-Works Association.

A New Spirit in Shipbuilding

BRILLIANT performances in high-speed shipbuilding made at the Pacific Coast yards during recent weeks are worthily matched, worthily surpassed by the record made at Camden, N. J. When the collier "Tuckahoe" was launched last Sunday, 27 days after the keel was laid, clear proof was given that a revolution has occurred in the building of ships. It is not a revolution in methods or devices, however, but a psychological one, that now gives us achievements which heretofore were impossible. The work at Camden was done in an old-line shipyard, not in one of the great high-pressure establishments created to meet the emergency of the day. For many years ships have been built there by substantially the same methods used in constructing the "Tuckahoe." Yet, with the old traditions, the men, the tools and methods which have produced ships in that yard hitherto, results of a new order of excellence were attained. There was a new, determined spirit of drive—a spirit that came from the men themselves even more than from the leaders. Realization of the country's need and of their high part in filling that need was the driving power back of their efforts. When the Western yards led the way, rivalry in patriotic efficiency brought the full effect of this power. The "Tuckahoe" performance will undoubtedly be repeated. For elsewhere than at Camden our shipbuilders are exhibiting the same determined spirit. It gives eloquent promise that the call for "Ships! Ships! Ships!" will be answered.

Elimination of Grade Crossings Can Wait

PERVERSION of the truth regarding railroad grade crossings is a popular pastime with many newspapers in the smaller cities. One such paper in Pennsylvania sees in the order of the railroad administration for the completion of the track elevation at Indianapolis a determination to push ahead and abolish grade cross-

ings generally. Of course, at the present time such a program is out of the question. Chicagoans, who have just seen their track-elevation programs set aside for the period of the war, have already learned that the railroad administration has nothing of the sort in mind. The case at Indianapolis is exceptional, not typical; the work there has gone so far that to suspend it would leave the streets and railroads badly torn up, and early completion of the work is necessary to reëstablish order. But in these days when men are being slain by the thousands on the battlefields of France, and when vast sums need to be spent on our transportation system to fit it for its part in the war, the average grade crossing can wait.

"Careless Yankee Business Methods"

MUCH has been said, in this journal and elsewhere, about careless methods in our business dealings with South American firms. Evidently not enough has been said. A correspondent in Buenos Aires has sent this journal no less than six envelopes received from prominent American companies, each envelope bearing a two-cent in place of the needed five-cent stamp. Besides paying postage due, recipients of such letters have to pay fines, and our correspondent states that "the individual fine per house per mail has been as high as one dollar." He further says: "Please do not miss a chance to give instructions on *heavy, compact and portable* crating for these markets. 'This side up' in English means nothing below the line. Every old German crate, one notes, has such (now rather dim) instructions in English, French, Spanish and German—a small detail which protects the shipment and *keeps the business.* It is *keeps* for which Americans must now strive in these South American markets." It is indeed. The war has given us an opportunity to get a good share of the South American trade. We must not forfeit the chance by a continuation of these "careless Yankee business methods."

Is Railroad Opposition To Canals Really Dead?

RUMORS current in Washington credit certain prominent railroad men with hypocrisy in their new-found advocacy of, or at least reconciliation to, a national policy of inland-waterway development. It is asserted that these gentlemen may accept the general policy of canal and river navigation, but as a theory rather than for local application. The president of a hypothetical Ohio valley railroad, for instance, may be strongly in favor of promoting the navigation through the Dalles canal; but he will fight the nine-foot-stage project on the Ohio with all the vigor he deems politic. If there are any of these railway executives in New York State and the districts tributary thereto they will find little solace in the latest order authorizing Mr. Tomlinson to operate the New York State Barge Canal. On the surface at least he is empowered to develop that waterway to its full possibilities. If he meets opposition either inside or outside the railroad administration, the order gives him a tactical advantage which he should not be slow to follow up with such weapons as public opinion and publicity will provide.

Central Recruiting May Solve Railway Track Labor Problem

CENTRALIZED control of the labor supply for maintenance and improvement on the country's railway system as a whole is a departure suggested by the committee on economics of railway labor in its first report, presented at the recent annual meeting of the American Railway Engineering Association. Such a change, in view of the new conditions that have risen, appears to offer far greater advantages than mere modification of present practice.

In order to secure a more uniform distribution of the limited supply of labor, and especially of unskilled floating labor, the committee suggested that joint agencies should be established in the large labor centers, preferably under control of the regional directors. They would coördinate their work with that of state and municipal agencies. Railways would call upon these agencies for such labor as could not be obtained along their lines. It may be pointed out that while native local labor is generally the best, it is usually insufficient in quantity, and the normal supply is now greatly reduced.

In order to utilize to the best advantage the labor thus supplied, and also facilitate the coöperative efforts, the committee suggested that each railway should designate some officer, familiar by training and experience with such matters, to study the labor requirements for proper maintenance. He would consider means of obtaining and utilizing the various kinds of railway labor.

The central-agency idea might be carried a step further by pooling common labor for use where needed. The distribution would then be under the direction of a central or district bureau representing the railways and subject to the control of the Government authorities.

Under ordinary methods, each railway plans its work regardless of the plans of other roads. If several railways in the same district start work at about the same time—and this may easily happen in the spring—the number of men available is likely to be insufficient. This is especially true now, on account of the reduction of the supply of native labor by the draft and the decrease in the foreign-labor supply due to emigration and the decline of immigration. With the demand in excess of th supply, the men may make their own terms and raise the rate of pay by forcing one road to bid against the other. If there is a similar demand in a number of districts, there will be much wasteful traveling of men looking for attractive jobs.

Still another unfavorable phase of the plan of employment is that it creates floating labor. When work on one road is nearing completion, reduction of forces begins and gangs are broken up. Another road in the neighborhood or at a distance may urgently need labor. But even it it should secure the men just released, still these men would have to be reorganized.

With the railways now operated as one system under Government control there is opportunity for the introduction of better methods, such as transferring forces intact from one job to the next, as outlined in a supplementary statement which was submitted by the committee.

Concentration of maintenance work on certain important routes is another way of conserving labor. This becomes praticable under Government operation, and direct routes between certain points, perhaps composed of parts of different railroads, may be kept up without regard to their different ownerships. The labor supply may thus be concentrated mainly on these direct heavy-traffic routes, instead of being scattered over a large mileage of main and secondary lines. When such composite routes are adopted it is likely that some parts will require more work and attention than others to bring them up to a uniform standard. As this heavier work is completed part of the force may be shifted to some other point needing improvement. Gangs may be kept together and transferred from one job to another, thus avoiding the wasteful practice of breaking up a gang in one place and organizing a new gang in another place.

Another aspect of the railway labor problem, the supply for the ordinary section force, may be dealt with by making the section gang a place for permanent employment. The waste of time, money and material in doing such work with an ill-paid and continually changing force has been pointed out again and again.

The labor situation has been a most serious problem in railway work for a number of years, but present conditions make possible changes that will be of advantage to all concerned.

Federal Restriction of Water Consumption May Yet Be Necessary

LAST winter's coal famine and car shortage led the United States fuel administration to dim the "great white ways" of which some of our cities were so proud, to curtail electric sign advertising and to enforce heatless and workless Mondays. Quite recently skip-stops have been imposed on street railways and the public. The United States food administration is preaching the utilization of city garbage. The Capital Issues Committee at Washington is curtailing loans for municipal purposes. In view of all these activities to save fuel, food and money to help win the war, is it not reasonable to suppose that such of the water-works of the country as are allowing vast quantities of water to go to waste unchecked must soon face the alternative of themselves taking radical measures to stop waste or of having the Federal authorities adopt drastic measures? The argument for stopping water waste is strong enough in the case of gravity supplies to demand immediate action, since if waste is not stopped the capacity of the works will soon be outrun and money, material and labor will be in large demand to make up deficiencies which might and should be avoided at this critical period. Where water is pumped the case is still more urgent, and delay in stopping waste should not be tolerated, even if the Federal Government has to assert its authority to that end.

The time is all too short for taking active and efficient measures to control waste before another winter of possible coal and car shortages sets in. District and house-to-house water-waste surveys should be instituted at once wherever the need exists. If meters are lacking a universal water-meter program should be formulated without delay. Under proper Federal regulation every obstacle to the provision of needed water meters should be swept away, if disinterested engineering opinion decides that to be necessary.

Stopping water waste is imperative. It will help to win the war.

Recent Steps Show Centralized Control of War Is Coming

FULL conversion of the industries of the country to the production of war materials is approaching nearer week by week as the War Industries Board takes hold of its gigantic task of coördinating the efforts of all the agencies working to focus the great potential strength of America on the battle front in France. The recent action diverting the entire steel-making capacity of the country to shipbuilding, munitions manufacture and transportation purposes, the demands of which must be met before a pound of steel can be used for less essential purposes, is proof of the fact that Mr. Baruch has the personal force and courage to accomplish results. At first it was doubted, in the absence of definite powers conferred by legislation, that the War Industries Board would be able to make itself felt with the promptness and force demanded by the emergency. Moreover, it was thought that even were a supreme war-making authority set up, with power to suspend the operation of every industry that did not contribute to military strength, it could not exercise this power without creating such confusion as to cripple industry.

Conversion of industry to war production, without closing down a single plant and without throwing out of employment a single man is, as this journal has consistently argued, the way in which the resources of the nation can be most effectively marshalled to oppose the German menace. Of course, the conversion cannot be effected so smoothly as to avoid all confusion; but it cannot be accomplished at all unless someone has both the courage and the authority to say plainly, "We must drop this and concentrate on that." Mr. Baruch has the courage; and events are proving that he has the authority. At least, he seems to have the necessary determination to "say something and make it stick," as the slang expression has it.

With an agency constructively in control of all Government departments having to do with war production, and able, as the War Industries Board is proving to be, to assume such control, there is the hope that vision and farsighted planning will govern the conduct of the war from now on, and that the change from peace to war production will proceed quickly and effectively. There is hope that striving for perfection before beginning quantity production, an error from which more than one important arm of the military service has suffered, will be eliminated. There is hope that we will not again see one branch of the Government set half the country humming on a production scheme which cannot reach fruition because it outruns the possibilities of some other part of the war machine on which it must depend for fulfilment. There is hope that the war will be conducted on an engineering basis; that is, scientifically planned on accurate and complete information, and carried out with energy according to the plans.

Water-Supply at the Front in France

Engineering Work for American Forces Centralized in Specialists—Horses Important Factor in Quantity Estimates—"Water Points" Must Be Provided—British and French Water-Supply Practice Reviewed

By Robert K. Tomlin, Jr.
War Correspondent of Engineering News-Record

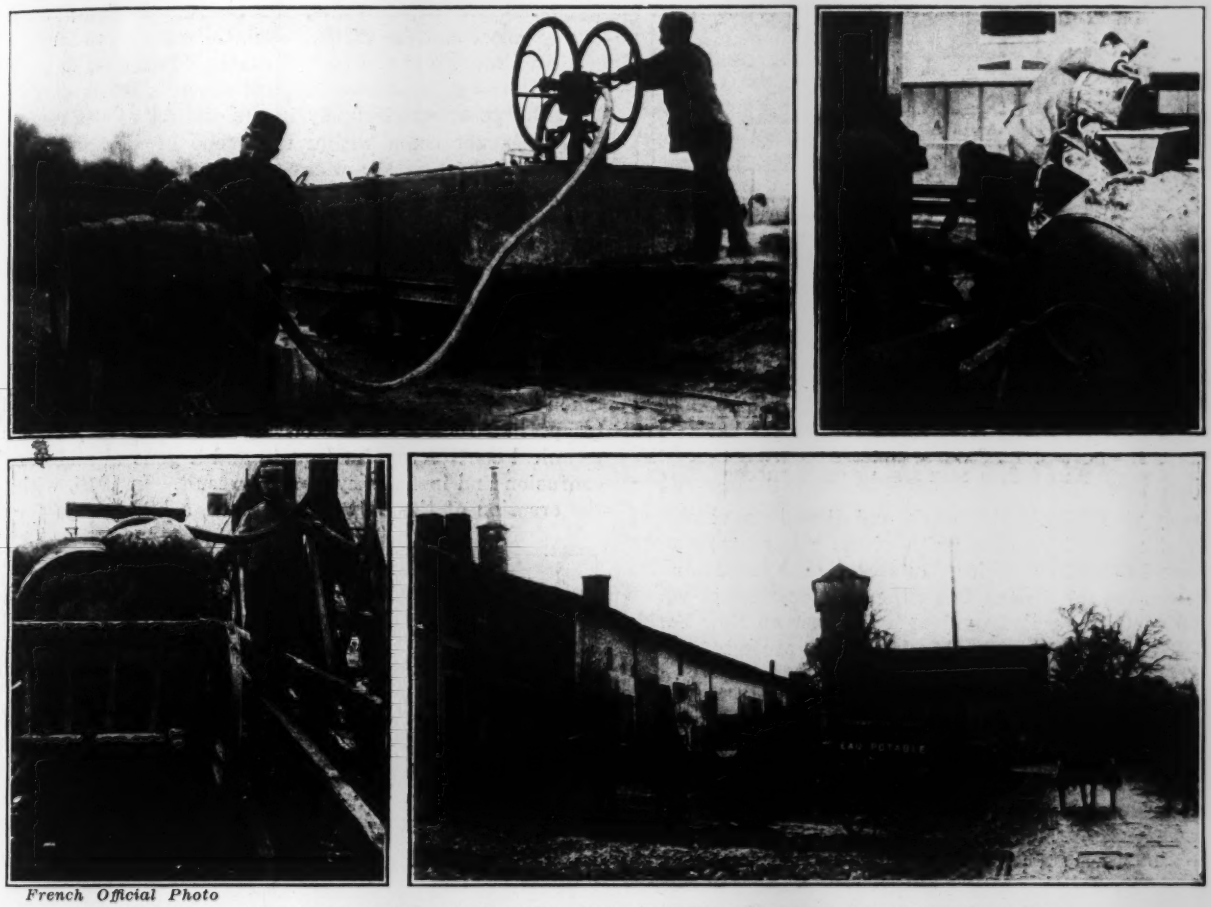
French Official Photo

A WATER PURIFICATION "PLANT" OPERATED BY THE FRENCH IN THE MARNE SECTOR

DURING a recent interview at our general headquarters in France, the chief engineer of the American Expeditionary Forces, in telling me about the activities of our technical troops, made this remark: "In addition to what you can now see in the field, our engineers have done a tremendous amount of work the results of which, as yet, do not all appear on the surface." At the time I did not appreciate the full significance of this statement. A little later that day, however, after I had been given an opportunity to inquire into the subject of water-supply for American forces in the field, its real meaning became clear. This problem, involving two great subdivisions, water-supply for the advance areas and for the sections of the rear, is one of countless ramifications; one that has demanded a prodigious amount of detailed preliminary investigation, for into its solution enter not only most of the factors with which the water-supply engineer in civil life has to deal, but also scores of others arising out of the special conditions of modern warfare.

These investigations of our army engineers in France have led along some strange bypaths, routes unexplored in the course of ordinary municipal water-supply practice at home. How much water does a horse or a mule drink daily? What is the minimum requirement per capita for troops during an advance? What is the best means of sterilizing water on the field? How shall pipe lines, pumping stations and tanks be protected from shell fire? Shall each army, corps or division be responsible for its own water-supply, or shall this matter be controlled for all of our forces directly from headquarters? To what extent can water be delivered by pipe lines, and how much pipe can be procured in France? Where should pipe-line delivery stop and transport by motor truck, light railway or animals begin? How much water does a soldier need for a shower bath, and how often should he be permitted this luxury? These are samples of the questions our water-supply engineers at the front have been busy answering. And from the answers it has been possible to evolve two very important things—a policy governing the supply of water to the American Expeditionary Forces and an organization to direct the work in all of its branches.

In the development of this organization we have been fortunate, for we have been able to profit by the experiences of the British and French armies, which have been placed so freely at the disposal of our engineers. We have been able, for instance, to avoid the mistake of making *mobile* units directly responsible for their own water-supply. We have, at the very beginning, done what our Allies did only after paying the price for their experience, and reorganizing their systems of water-supply: We have organized water-supply on a *geographical* rather than upon a shifting military unit basis. By this I mean that the service of water-supply has been established as an organization attached to headquarters, and, through the chief engineer, A. E. F., exercises central



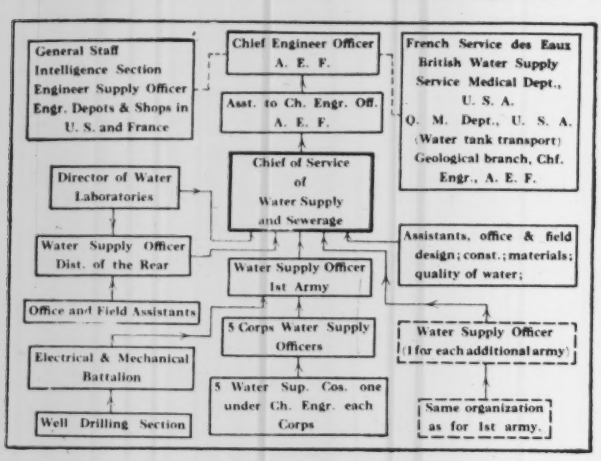
French Official Photo

VARIOUS FORMS OF CARTS ARE USED FOR WATER DELIVERY IN ADVANCE AREAS

and direct control over all field operations by means of districts. *The geographical constancy of the men engaged in water-supply field work, therefore, is assured, irrespective of the shifting from one sector to another of divisions or other units.* The big advantage of this plan is that the water-supply force in each district remains continually in charge of work with which it is familiar, instead, as was the case in the first year of the war, of being moved from one locality to another, facing a new set of conditions, with regard to the supply of water, at each shift. The accompanying diagram of organization indicates the tentative lines along which we are working, and is of course subject to modification as experience shows such alteration to be desirable.

The principal uses of water in the forward areas—and it is with the forward-area work only that this article will deal—are these: Drinking (men and animals); laundry; culinary; locomotives and steam boilers; washing wagons and harness; shower baths and fire protection. Behind a rapid advance of troops the following methods of supplying water are employed: (1) Hand portage in bottles and cans. (2) Horse-drawn carts. (3) Tank trains and cars. (4) Construction of new water delivery points. (5) Laying new pipe lines. (6) Equipment of advance pumping stations. Each case determines the method or combination of methods that will serve best. Past experience has shown, however, that most advances are more or less intermittent, with lapses of time between movements, which allow the water-supply forces to install first-aid pumping stations, pipe lines, and water points for the use of large numbers of horses, hauling artillery and supplies. This work must be done under shell fire. Pipe lines are broken and must be kept in repair. Mechanical equipment is pretty much of a minus quantity. Casualties deplete the working force. But come what may, the water-supply engineers must stick to the job and keep the delivery of water close up behind the troops moving ahead.

Having reached the decision that geographical constancy should be the basic element of the Army water-supply work, the chief engineer, A. E. F., authorized the creation of a new department, the Service of Water-Supply and Sewerage, and placed at its head a colonel of engineers who, after graduation from West Point and service some years in the corps of engineers, became associated with Allen Hazen, consulting engineer, New York, for whom he took charge of many important water-supply projects, among them being the large filtration plant at Toronto. The chief of the water-supply service, A. E. F., is responsible for all water-supply and sewerage work undertaken by the forces in France, including design, construction, supply of materials, laboratory control of quality of water, and investigation of water resources. Collaborating

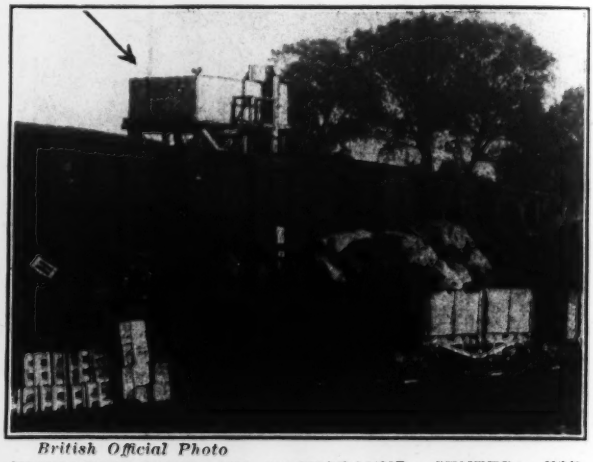


TENTATIVE ORGANIZATION SCHEME FOR WATER-SUPPLY OF AMERICAN FORCES AT THE FRONT

closely with him in this work, and directly in charge of the office which handles much of the water-supply work connected with American interests in France outside the zone of the armies, is another engineer officer whose qualifications result from long experience on New York's Catskill Aqueduct and other important projects.

The field work, as now contemplated, will be controlled by districts, each district including the area occupied by one army. The district, in turn, will be subdivided into sections for each army corps. There will be, therefore, water-supply officers representing the chief water-supply officer, A. E. F., in each army, and in each corps area. If a corps should move to a new position in the field, and another corps take its place, the original water-supply officer of the corps would remain. For every army there will be, also, an electrical and mechanical battalion and a well-drilling section, reporting through the chief engineer of the army to the water-supply engineer of the army. Through each chief engineer of a corps the water-supply officer of the corps will have control of a water-supply company, made up of picked men. Then, too, there will be a director of laboratories, with a staff of assistants for office and field work, reporting to the chief water-supply officer, A. E. F. Through the chief engineer, A. E. F., contact will be had with the British Water-Supply Service, the French *Service des Eaux*, the medical and quartermaster departments, U. S. A., the engineer supply officer and the various engineer depots and shops both in France and the United States. There is, in addition to the organization outlined above, a force which is in charge of water-supply in the district of the rear. This does not come within the scope of this article. It reports through the water-supply officer, district of the rear, to the chief of the water service, American Expeditionary Forces.

In organizing our water-supply work along the lines indicated we have followed in a general way the scheme which has been found to give the best results in both the French and the British armies. In the early days the French delegated the work of water-supply to each division, to be performed as fatigue duty by troops taken at random from tactical units. Generally these troops had little or no knowledge of the work, their technical control was inadequate and a general state of confusion and inefficiency was the result. In 1915, with the creation of the *Service des Eaux*, a big change for the better was wrought, for in each army a chief of water service was appointed and about 1000 engineer troops were given him for the performance of water-supply work. A similar change occurred in the British armies, where, until 1915, field companies were assigned to water-supply. The creation of a separate service, composed of men trained in this branch of engineering, became imperative and the Service of Water-Supply for the British armies was the outcome.



British Official Photo
ELEVATED TANK (IN BACKGROUND, CENTER) FOR SUPPLYING WATER TO RAILWAY LOCOMOTIVES

French Official Photo
A HASTILY MADE "WATER POINT" FOR HORSES—TROUGH MERELY A WATERPROOF CANVAS SHEET HUNG OVER A WOODEN FRAME

The chief of the water-supply service for the American forces and his assistants have made a thorough study of methods employed behind the British and French fronts. To a large extent water for our allies is obtained from wells. The British territory is underlaid with chalk, and it is necessary to sink driven wells from 150 to 250 ft. to reach the level of saturation. With two shifts the drilling progress on a 6-in. hole varies from 20 to 60 ft. a day, and the yield per well may range from 50 to 150 gal. per minute. In the Somme valley, British troops used river water, which was passed through purification plants mounted on barges. About four-fifths of the French army water-supply in the region of Verdun was obtained from wells. Wells dug by hand, in addition to drilled wells, are also

employed to some extent—one of these was put down to a depth of 65 ft. If time permits, these dug wells are lined for the upper 10 or 12 ft., and a curb 2 ft. high is built around the top to prevent débris or waste water falling back into the well. For dug wells a round section about 4 ft. in diameter is common.

The engineer in civil life who is accustomed to design a water-supply system on the basis of a consumption of 150 to 200 gal. per capita per day must reconstruct his ideas when he reaches the front and compares these figures with military allowances for advance areas. For an advancing army the consumption oftentimes must be as low as ½ gal. per soldier daily. Three days after the beginning of a movement, during which time the water-supply forces have been able to extend their lines forward, the allowance per man daily is increased to 1 gal. For the guidance of engineers of our army water-supply forces, the following table of allowances and rationing, based on the experience of the British and French, has been prepared:

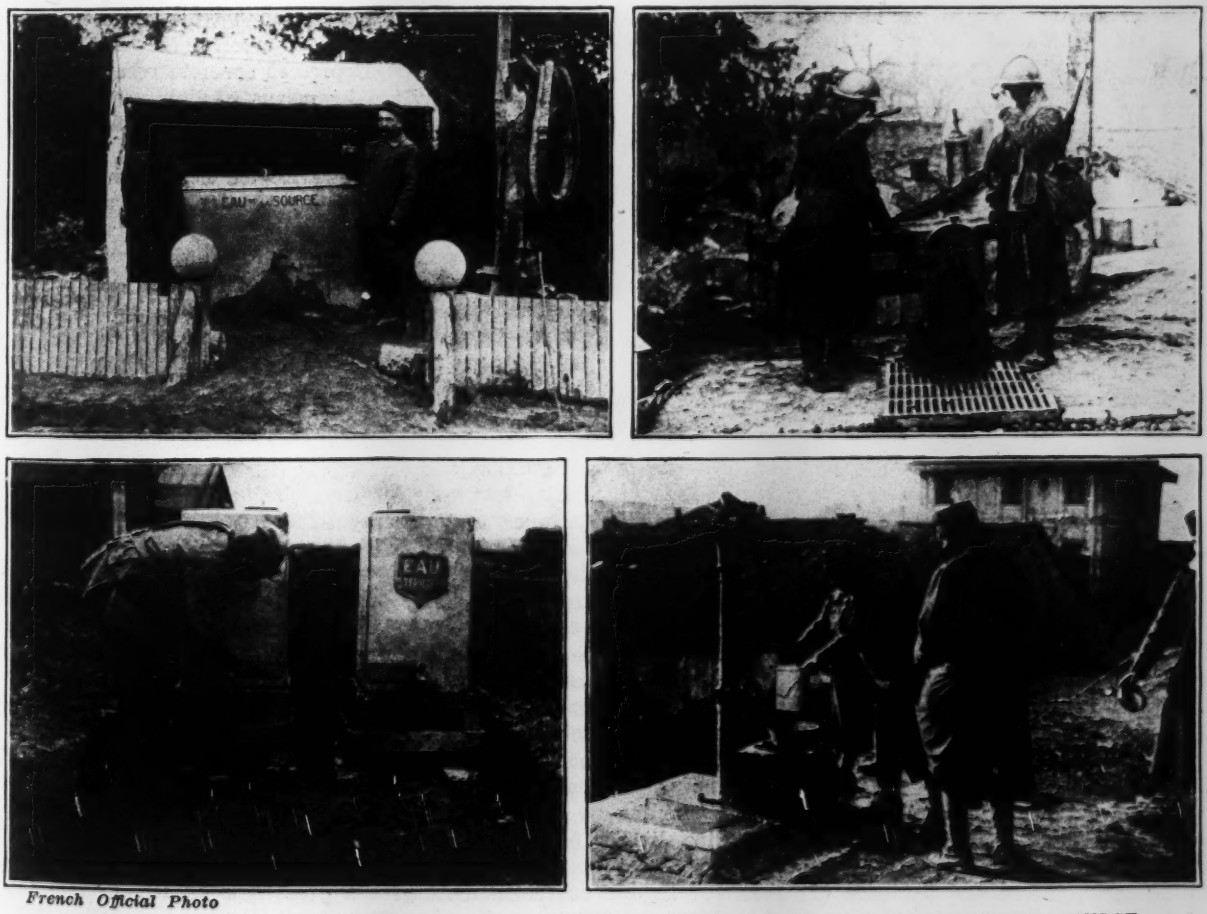
WATER-SUPPLY ALLOWANCE AT THE FRONT

Kind of Service	Gallons per Man or Animal per Day
Advancing army (men)	0.5
Animals (drinking)	7.5
Army after 3 days (men)	1.0
Field hospital	5.5
Rear regions	10.0
Base hospitals	25.0
General use at stables	10.0

As to the allowance of 1 gal. per man daily, British records show that a 6000-gal. overhead canvas tank, filled once a day, supplied an army camp of 6000 men without serious complaint. Of course, in this case, as in all others where water is at a premium, a very strict surveillance is kept over consumption, and policing at water points prevents waste. In the instance cited no cart was allowed to fill from the overhead tank without a ticket of permission from the area commandant.

For advance areas the present war has developed the "water-point," which assumes various forms. It may be a well, the end of a pipe line, a trough, an elevated tank of metal or wood, or merely a reservoir of canvas. It establishes, however, a line of demarkation between the work of the special water-supply forces and the troops in the field—between producer and consumer. The water-supply service establishes these water points at frequent intervals, and divisional or other units must assume responsibility for getting the water from them to their men and animals by light railway, wagon transport, motor truck, hand carrying, or such other means as the local situation may demand.

During an advance the sequence of operations relating to water-supply begins with horse-drawn transport by individual military units from existing water-delivery points. Then, as the distance from these water bases to the new front increases, water-tank trains operate up to a point where pack-mule or other service begins. These water-tank trains are operated by the



French Official Photo

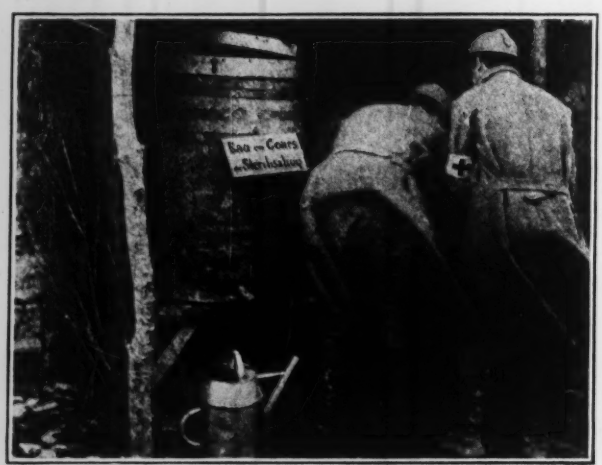
A FEW OF THE PLACES ALONG THE FRENCH FRONT WHERE POILUS MAY QUENCH THEIR THIRST

quartermaster department, and tide over the period during which engineers of the water-supply service are establishing new water points in advance of the old ones. It is absolutely essential for the success of the movement of troops forward that the distance between water points and the rear of advancing units shall not be so great as to make transport of water difficult. As a general rule, I am told, this distance should not exceed four or five miles. The extreme range of water-tank transportation is set at 10 miles, to which not more than three miles should be added for delivery by small carts or pack mules. Obviously, any such distance as 13 miles between a water-delivery point and the point of actual consumption can be maintained only for a very short time. If the roads are congested this distance must be halved to insure service that is at all effective.

During forward movements frequent use is made of "first aid" tanks. These are established as far forward as possible, and offer a means of supply until a more permanent water point can be established. These "first aid" tanks are nothing more than large pieces of sail-cloth, waterproofed with tar and pitch, or linseed oil and pine resin, laid directly on the ground and banked up around the sides with sand bags. It is desirable to cover them with some form of camouflage screen as the reflection of the water in the sunlight discloses their position to aviators.

French Official Photo

THE SOLDIERS IN THE TRENCHES MUST HAVE MEANS OF FILLING THEIR WATER BOTTLES



French Official Photo

WATER IN BARREL AT LEFT IS BEING STERILIZED (PROBABLY BY HYPOCHLORITE OF LIME)

Traveling along the roads back of the front one sees numbers of these water points. A typical one (British) consists of one 9000-gal. canvas tank; one 2300-gal. canvas tank; one 200-gal. galvanized-iron tank; six 600-gal. canvas horse-troughs; one water-bottle filler.

Here are a few other types: (A) Air-lift pumping station; 2800-gal. tank reservoirs; main pipe line; elevated storage tank, feeding (1) elevated trough for filling carts, trucks and flat cars (2) tank for filling canteens (3) watering trough for animals, with corduroy "standing" and heavy guard rails around it (B) Pumping station delivering water from stream; elevated storage tank; pipe line to distribution troughs and elevated tanks for filling trucks (C) Well-pump in tent delivering direct to trough (this layout included a fire-hose under a culvert crossing as part of the main pipe line (D) Depressed concrete reservoir filled with water delivered by means of light railway tank cars; pipe line to elevated troughs for filling water carts; also concrete troughs for animals.

Water points should be located near highways, but not directly alongside main routes, as they would tie up traffic. Where horses must be watered it is very important to build "standing" around the troughs—this may be plank or any other paving material which offers solid support. Without "standing" the horses' hoofs cut up the ground until it develops into a veritable bog. Among the considerations which must enter into the location of a water point are ease of access; permanency; demands upon the supply; liability to congestion; safety from shell fire; concealment from enemy observation, and drainage.

The last consideration, drainage, is of great importance, and where possible a water point should be located on a side-hill. In this case water slopping over during the filling of tank wagons or spilled along horse troughs is quickly carried off, preventing the formation of mud. It is difficult to have a true appreciation of the mud over here unless one has actually tried to navigate through it. Officers of our water-supply service have told me that several of the large water points established by our allies had to be abandoned because of poor drainage facilities. The stamping of thousands of hoofs daily around a water point puts the ground to a severe test, and it must be well drained and paved if it is to be of any use.

In the design of water delivery points at the front, engineers must give a great deal of attention to the horse and mule. This applies not only to the actual

design of troughs, etc., but also to computations and estimates of the quantity of water it is necessary to provide. A few references to conditions earlier in the war will serve as illustrations. Back of Verdun in 1915 the French had a concentration of 175,000 horses. For 100,000 animals in the second army (French) alone it was necessary to supply daily 2,800,000 liters of water, equivalent to about 7½ gal. a head. Another census at a French veterinary hospital, with 1200 horses, showed a per capita consumption of 8¼ gal. daily, this figure including water used by attendants, waste, washing horses and cleaning troughs. In the valley of the Somme the British, during one week, supplied 50,000 horses with an amount of water equivalent to 5¼ gal. per head per day. Ordinary British practice, however, has adopted a daily supply of 8 gal. per horse daily.

So important is the matter of horse watering in modern warfare that it is one of the controlling factors in water-supply estimates. In a recent report the water-supply officer of the American Expeditionary Forces devoted many pages to this subject—and the report, let it be said, was on the general work of advance-area water-supply, not specifically on water-supply for animals. The tables of organization for the United States Army show, approximately, about 1 horse per 5 men, but in an advance the animals will be concentrated at the front so that the ratio may change to 1 horse per 3 men, as is said to have been the case in the French forces back of Verdun. Thus, recalling the fact that an animal needs from 7 to 10 times as much water as a man, it is clear that the water-supply engineer must often provide more water for animals than for the men actually engaged in fighting.

The watering troughs are simple affairs, consisting generally of wooden frames supporting canvas containers. They extend often to great lengths, however. The British have one run of trough 720 ft. long, composed of eight 90-ft. sections, fed from three 1500-gal. canvas tanks elevated 15 ft. above ground. Separate lines of 4-in. pipe deliver water to groups of four trough sections. At this point a city fire engine pumped 10,000 gal. of water an hour into the tanks, which, however, were bypassed, and delivery was made directly into the troughs when horses arrived in large numbers. The chief of our water-supply service, during his investigations among the British and French armies, found that a trough gives from 100 to 150 waterings per yard of trough daily, but that with good service and constant watering throughout the day this number can be doubled. The French have found that when horses succeed one another without interruption along a 20-m. trough, at least 8 cu. m. of water per hour must be supplied. About 6000 waterings a day is an ordinary performance for a 20-m. trough. As a rough guide, the British estimate 200 horses per hour at a 30-ft. trough. A 90-ft. trough, it has been found, can accommodate 40 horses on each side at one time without undue crowding.

In addition to the figures covering the drinking water allowances for men, previously given, the following on shower bath requirements are worth noting: A 6-in. shower head must be fed with at least 3 gal. per minute (the pressure of course being very low). Four such shower heads, supplied with from 800 to 1000 gal. per hour, are estimated to be sufficient for baths for 2000 men in 24 hours.

The experience of the British and French has indicated the desirability of having as few different sizes of pipe as possible. Wrought-iron pipe, 18-ft. lengths with screw couplings, in three sizes, 1, 2 and 4 in. in diameter, is much used and has demonstrated its usefulness. During a hurried advance pipe must be laid on the ground surface, but in this position, of course, it is exposed to rupture by shell fire, and should be covered at the earliest opportunity. Pipe should never be laid on the surface in continuous *straight* lines, as expansion due to the sun's heat is apt to cause breaks. Wavy lines are always recommended.

The British practice is to have an advance pipe-laying gang proceed with all rapidity, leaving gaps in the line for sharp bends, specials, or where extra work would consume valuable time. This first gang is followed by a "make-good" party, whose job is to connect up sections of the line left unfinished by the forward gang—for example, at highway or railroad crossings. Behind the "make-good" party comes a third gang which tests the line and places the back fill. Screw-

French Official Photo
ELEVATED WATER TANK SUPPLIED BY NEARBY SPRING, ALONG ROADSIDE IN THE SOMME VALLEY

joint pipe laid on the ground surface has been pulled over into trenches without much damage—but it is better to lay the pipe originally in the trench if conditions permit of the digging of the trench first. Pipe-line trenches are about 2 ft. wide and 2½ ft. deep, as a rule. While it is possible with straight wrought-iron pipe to make bends, cold, in the field, the better practice is to provide lengths of bends in advance.

According to the recommendations of one of our army water-supply officers, a pipe-laying gang should include one noncommissioned officer and six men—four to handle the material and pipe tongs and two to fit and grease or lead the joints. In good weather it is possible for one of these gangs to lay 40 lengths of 18-ft. pipe (4 in. in diameter) in eight hours. These figures are for laying on the ground surface or in prepared trenches under favorable circumstances. Cases arise which require this progress to be liberally discounted.

To prevent breakage by shell fire, a 2½-ft. earth cover over a pipe line is regarded as sufficient, except in case of a direct hit. In the case of an uncovered pipe

line a high-explosive shell bursting on hard ground 30 ft. away will rupture the joints. Pending the digging of a trench, however, pipe on the surface can be protected in a measure by laying sand bags over exposed joints. When shrapnel bullets puncture a line repairs can often be made, where the pressure is low, with plumber's tape. For larger holes split sleeves are useful. When whole pipe lengths are sprayed with shrapnel the section must be taken out and replaced. On the repair work it has been found advantageous to have a fairly plentiful supply of one-half and one-quarter lengths of pipe with long screw threads and sockets.

The work of the water-supply service of the American Expeditionary Forces includes also supervision over the quality of the water furnished to our troops. The British and French have used hypochlorite of lime for this purpose, but our engineers have developed plans for the extensive use of liquid chlorine apparatus of the Wallace & Tiernan type. Some of these outfits, I am informed, will be mounted on motor trucks.

What has been said in the foregoing notes refers exclusively to advance area water-supply. This is only part of the story. Back of the front at our supply bases and along our lines of communication many water-supply projects, some of them involving filtration plants, are included in the program of work for our Army water-supply service. In a later article I hope to give an outline of water-supply in the district of the rear.

Grappling with Water-Works Problems at St. Louis

Rates Made More Simple and Rational—Water Intakes Protected from Ice and Shifting Channel—Three-Point Support for Gate-Valve Disks Operating Under High Pressure

Flat and Meter Rates Revised

By E. E. Wall
Water Commissioner of St. Louis

REVISED water rates for St. Louis will go into effect about June 1. The more than a hundred divisions in the sliding scale of meter rates for general consumers will be reduced to a dozen. Special meter rates for manufacturers and others will be changed, and some inconsistencies in flat or schedule rates will be eliminated. The various changes are embodied in an ordinance which was before the board of aldermen for nearly a year, during which time it was the subject of a number of public hearings and wide discussion.

The range of meter rates for general consumers (offices, stores, residences, stables, etc.) remains unchanged at 15 to 5c. per 100 cu.ft., but the steps down are now 1c. instead of 0.1c., with the exception shown in the table. The bills for a given quantity of water will be almost the same as before.

Changes in special meter rates are as follows: Manufacturers, raised from 4½c. flat to 6 to 4½c. (see table); hospitals and charitable institutions, changed from half the old general consumer's rates to 4½c., but proof must be supplied that not less than 10% of the inmates are admitted free; swimming pools, reduced from 4 to 3c. The public schools will be charged 6c. per 100 cu.ft. The special manufacturer's rate does not apply to power plants, nor where manufacturing is an incident to the main business, nor unless the manufacturer has a service for his exclusive use.

Some Flat Rates Depended on Inspectors

The old flat-rate schedule had numerous inconsistent rates for premises of practically the same size occupied by different kinds of business, but apparently using about the same quantity of water. It provided an indefinite and sliding scale of charges for certain classes of stores, halls, offices, etc., so that the actual charge for water in many cases was dependent entirely upon the judgment of the inspector. It often happened that a change of inspectors in a district resulted in a revision of the charges made on many of these premises. It was comparatively easy to make a fair adjustment of the rates applying to premises of practically the same size using approximately the same amount of water, many of which had been previously tested by taking a meter measurement of the quantity of water used.

The method of assessing the rates for stores, halls, offices, etc., was changed to that of proportioning the charge to the superficial area in each case. Premises of various sorts employing a number of people are assessed under the new ordinance according to the number of employees, the rate per individual varying with the kind of work being done. Small restaurants, ice cream parlors, coffee houses, tea rooms, etc., will be charged according to the number of chairs for guests.

Hose charges, which have long been a source of great annoyance and trouble, are not altered. The charge is still 4c. a front foot for the year. This is ridiculously low, but all efforts to increase this charge, as well as all attempts to restrict the use of hose to certain hours of the day, or to prohibit the use of all automatic sprinkling devices, resulted in failure, and the charge remains practically the same as before.

The old flat rates for residences, which have been in effect for many years, and which provided a charge per room ranging from 60 to 80c., have all been placed on a flat schedule of 70c. per room.

Residence Vacancy Allowances Abolished

The existing law provides that apartment houses, tenements, flats, buildings with stores on the first floor and rooms above, shall be allowed a refund on their licenses for all vacancies existing in any portion of the premises for a period of 60 days or more. During the year which ended Apr. 1, 1918, these refunds amounted to $27,614, which is not quite 10% of the total amount collected from these premises. The new bill has abolished this allowance, and in lieu thereof has reduced the former charge by 10%. The unending series of annoyances, both to the office and to the owner, and the disputes consequent upon deciding whether or not the vacancy existed for the time the law required, led to the abolition of this feature of the old schedule.

An effort was made to abolish the custom of allowing a discount of 10% on all bills paid before the tenth of the month. The reduction in the revenue on account of this discount amounts to about $250,000 per year—

and in view of the existing war prices, it seemed the easiest way to increase the revenue without making a special increase in the water rates. This matter was also compromised by allowing the discount to apply to all flat-rate consumers and to all general consumers under the meter schedule, but the discount was abolished on all special rates.

The new rate schedule will simplify bookkeeping and it is hoped that it will lessen disputes between the general public and the office. The new meter schedule will, no doubt, prove more satisfactory than the old, and the abolition of the allowance for partial vacancies and of the discount of special rates should facilitate the general work of the office. While there is no doubt that a considerable improvement might be made in the new rates, yet the water division feels that it has made a certain amount of progress in the proper direction.

METER RATES FOR GENERAL CONSUMERS AT ST. LOUIS

Use per Six Months, Cu.Ft.		Cents per 100 Cu.ft.
For the first	3,000 or less	15
For the next	3,000 or fraction thereof	14
"	4,000	13
"	5,000	12
"	10,000	11
"	15,000	10
"	100,000	9
"	260,000	8
"	3,600,000	7
"	4,000,000	6
"	10,000,000	5½
For all over	18,000,000	5

SPECIAL METER RATES FOR MANUFACTURERS AND PUBLIC OR QUASI-PUBLIC PURPOSES

For the first	5,000	6
For the next	10,000 or fraction thereof	5
For all over	15,000	4½

Hurdle Dikes Protect River Bank at Water Intakes

By W. W. Patton

Assistant Engineer, Supply and Purifying Section, St. Louis Water Department.

BANK protection on the Illinois shore of the Mississippi River has been necessary to prevent changes of the channel which would affect the two intakes of the St. Louis water-works. Intake No. 1, built in 1891, is 1500 ft. from the west shore; No. 2, built in 1914, is about 2100 ft. from shore, 300 ft. above the old tower and near the middle of the channel.

During the construction of the new tower rapid erosion occurred on the Illinois bank for about 3½ miles up stream. To prevent a possible change of the channel to the Illinois side of the river, and the consequent filling in around the two intake towers, it was decided to protect the bank with a mat and riprap. In 1913 a contract was awarded to the McMurry Construction Co. to build 11,500 ft. of willow mat and riprap bank protection extending from Chouteau Slough southward. This work was finished in 1914, but erosion of the bank continued below the end of the new work until 1917, when the bank had receded a maximum distance of 800 ft. opposite the towers. This widening of the channel caused sand bars to form above and around the new tower, a maximum depth of 10 ft. entirely covering the lower gates of the new tower. To check further widening, plans were made for a series of four hurdle dikes, extending from the Illinois shore into the river as far as the outer harbor line, and a dike 260 ft. long across the slough.

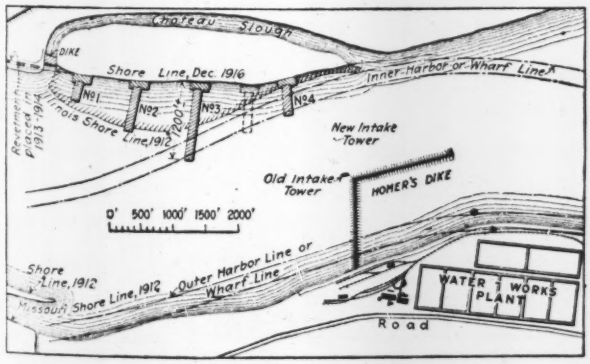
PILES WERE BANDED IN CLUMPS OF THREE

On Mar. 17, 1917, a contract was awarded to the Seitz-Peterman Contracting Co., for building the hurdle dikes and the plank mattress work, grading the bank and revetting the same, for the following prices: Mattress work, 6½ cents per square foot; grading, 15 cents per cubic yard; stone in place, $1.75 per cubic yard; piling delivered, 15 cents per lineal foot; driving piling, including the erecting of stringer, 17 cents per cubic foot.

The dikes are of the type used by the United States engineers in the St. Louis district, and consist of three rows of pile clumps driven through a willow or lumber foundation mattress which has been sunk to place with stone. The shore is protected at the end of the dike by a mattress 300 ft. long, 100 ft. above the dike and 200 ft. below. The bank is graded to a slope of 1 on 3 and the slope covered with a 4- to 6-in. layer of spalls, on which is spread a 12-in. layer of riprap with the voids filled with spalls. The dike across the slough is of a similar construction, but consists of only two rows of clumps.

The upper row of piling is driven 40 ft. below the upper edge of the channel mat. The elevation of the top of the two upper dikes is 95 on the Chain of Rocks gage and on the lower two it is 93. The average stage of the river while the work was being done was between 79 and 81, the elevation of the river bottom being about 71. The piles had a minimum diameter of 8 in. at the small end and were driven butts down. The tops of three piles were drawn together and cabled, forming a clump. Piles were about 4½ ft. c. to c. and three rows of clumps with the two rows of stringers between make very nearly one pile per lineal foot of dike. Drift and ice collected during the winter and during a rise of the river in March caused considerable filling in of sand below the dikes. By the middle of April four sand bars appeared at a river stage of 84.

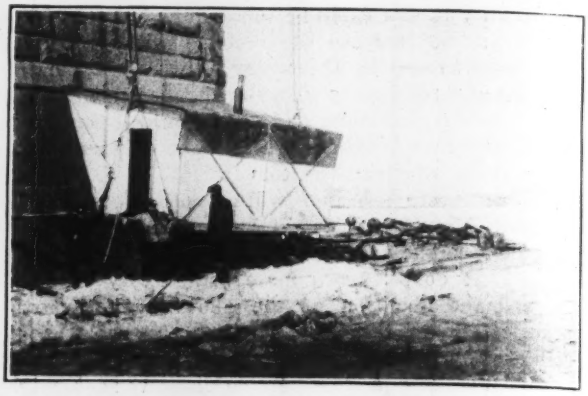
In January of this year, when the river was frozen,



DIKES PREVENT CHANGES OF RIVER CHANNEL AT ST. LOUIS WATER INTAKES

much concern was felt over the safety of the long dike when the ice would break in the spring. To create a line of weakness in the ice outside the dikes, the contractor and the employees of the water department dynamited the ice from a point below No. 3 dike to the Illinois shore on a line about 100 ft. outside the ends of the dikes, expecting the ice to shear along this line and protect the piling which was then not clumped. When the ice moved on Feb. 12 it did not shear on this line all the way but sheared on a line further out in the channel and no damage was done to the dikes.

As a result of the construction of the dikes, which on May 1 were about 85% completed, the sand has been entirely removed from the west side of the new tower and has been reduced to about 3 ft. on the east side. It was possible to use the lower gates on the west side during the ice troubles last winter.



MEN ON SUSPENDED PLATFORM CLEAR ICE FROM ST. LOUIS INTAKE TOWER

The crib diverts ice from ports

Keeping Ice from Ports of Water Intake

By C. M. Daily

Engineer-in-charge of Supply and Purifying Section, St. Louis Water Department.

REMOVAL of ice from the ports of the old intake of the St. Louis water-works is effected by men working on a platform suspended from the tower. To lessen the amount of ice that reaches the ports a boom is fastened to and just above the head of the tower.

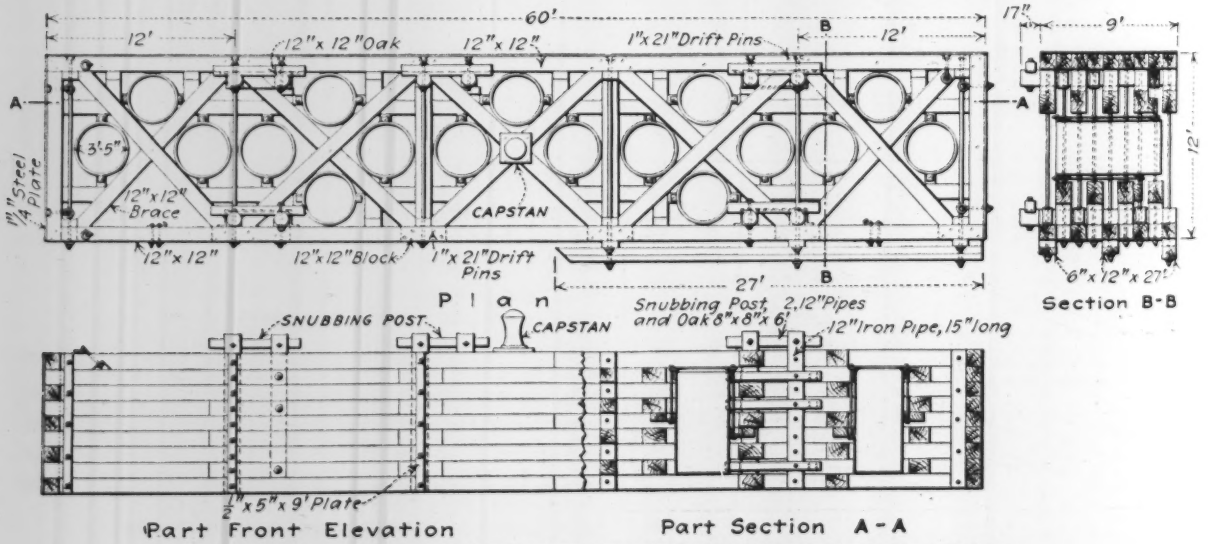
The tower was built parallel to the current of the Mississippi River, but, due to subsequent changes in the channel the current now strikes the tower at an angle of about 15 degrees, sweeping the rock clean on the east side and forming sand bars on the west and south. During the periods of running ice it has been very difficult to keep the gratings free from the ice which is forced into them by the current—reducing the supply to such an extent that it was often necessary to shut down the pumps.

To overcome this, a suspended platform on which several men can work is erected, late every fall, on the east side of the tower. The platform is held at a distance of about 3 ft. from the tower, and is built with canvas sides and roof. A stove and benches are provided for the comfort of the workmen. This platform is kept within a few feet of the water, and the men are provided with suitable tools to keep the gratings open. The top of the gratings are usually exposed when trouble from the ice is experienced.

The work of keeping the floating ice away from the ports was reduced by placing a timber shear boom above and fastened to the head of the tower. The strains and wrenching to which the boom is subjected required other than barge construction. A boom was destroyed by the ice in 1911 and the one now in use was built in 1912.

The new boom is a timber crib, 12 x 60 ft. in plan, 9 ft. deep, in which are built 17 bouyancy cylinders, 39 to 42 in. in diameter, and 7 ft. deep. They are composed of ¼-in. steel plate. These cylinders float the boom about 2½ ft. above water.

Before the ice starts running in the fall the boom is placed against the head of the tower, with the stern projecting out into the current at an angle of about 45 deg. from the face of the tower. It is held in place by chains and a cable fastened to anchor rings in the tower. At low water the boom rests on the rock bed of the river, affording an ideal protection from floating ice.



TIMBER BOOM WITH BUOYANCY CYLINDERS PROTECTS INTAKE PORTS

The boom does not prevent frazil ice from entering the port. Under certain conditions, this taxes the ice handling machines in the wet well, on shore, to their capacity, and in 1912 it caused a water famine for ten days.

While the river is frozen the boom is of no particular use. It then becomes a source of trouble, as to leave it in its working position until the ice broke up in the spring would be abandoning it to destruction by the ice jams. It is usually moved while the river is frozen to a protected spot below the tower, where the conditions are more favorable for its protection.

Last winter the work of moving the boom was started Jan. 20, when the river stage was high enough to float it. Dynamite was used to break the ice, while men with long pike poles shoved the broken pieces under the ice sheet into the current, which carried it away. The ice close to the boom was chopped away, and when free the boom was allowed to swing around against the east face of the tower and was then floated below the tower and securely fastened with chains, cable and lines. The work required eight men working four days.

When the ice broke on Feb. 12 and jammed against the tower and boom, every chain, cable and line was strained to what seemed almost breaking point. However, the only damage done was the crushing of one pontoon, which was easily repaired.

Supporting the Disks of Large Gate Valves Operating Under Pressure

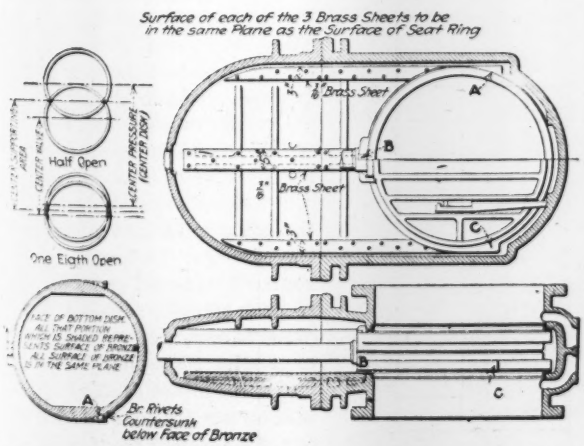
By K. Toensfeldt
Principal Assistant Mechanical Engineer, Operating Section, St. Louis Water-Works.

Hydraulically operated gate valves were recently needed in the discharge lines of two turbine driven centrifugal pumps at the Chain of Rocks station of the St. Louis water-works. One of these is a 42-in. and one a 60-in. valve and each will lie horizontally in a vertical pipe. There will be a condition under which the valves will be opened with the 60-ft. head on the disk. This will occur when it is desired to flush back the pipe below the valve.

When the valve is opened (see illustration) the center of pressure (the center of the disk) moves ahead of the center of support (the center of the bearing area of the lower seat and disk rings). The former moves away from the center of the valve with just twice the speed of the latter, decreasing the length of the supporting area between the disk and seat rings. This length of supporting area offers the only reaction to the turning tendency of the disk and soon becomes so short that the disk will tilt and scarf the edges of the seat and disk rings unless it is properly guided.

The illustration shows, at A, B and C how the disk is supported on three points throughout its travel. The three tracks are faced flush with the surface of the seat ring, so that the disk travels parallel with the seat ring and cannot scarf.

This design, which seems to be somewhat new to valve builders, suggests that it is necessary to make a careful study of the conditions under which a valve will operate and to embody them in full in the specifications.


Surface of each of the 3 Brass Sheets to be in the same Plane as the Surface of Seat Ring
Half Open
One Eighth Open
Brass Sheet
Brass Sheet
A
B
C
Br. Rivets Countersunk below Face of Bronze

DISKS OF VALVES UNDER PRESSURE ARE SUPPORTED AT THREE POINTS THROUGHOUT TRAVEL

St. Paul Water Bureau Thaws Frozen Services

Unusual severity of the past winter at St. Paul, Minn., combined with a decided deficiency in snow to act as a protecting blanket, resulted in the freezing of over 1000 water-service connections, as well as of a few small mains at dead ends and hydrants. The thawing of services is undertaken by the bureau of water, which with the use of an electric machine operating 24 hours daily was able to relieve the connections from obstructions promptly. Consumers suffered little inconvenience.

The electric thawing machine, which the bureau has had in service for two years, consists of a Capital City engine directly connected to an electric generator through a flexible coupling. The capacity of the set is 20 kw.; that is, it was guaranteed to deliver 500 amperes at 40 volts when running at 1000 r.p.m. By means of a rheostat mounted on a switchboard the voltage may be varied from 0 to 40, giving a very flexible piece of apparatus. As described by G. O. House, general superintendent, this machine is mounted on a rigid frame and is transported as a unit, either on a trailer or a truck. It weighs about two tons.

During December, 1917, and January, 1918, 87 service connections were relieved of ice at a cost of $4.38 each. During February, 1918, 799 service connections were treated at a cost of $2.35 each. The average price for thawing each service connection based upon the total of 886, was $2.54, the total expense being $2256.46. This includes the salaries and wages of men engaged in doing this work, together with the service of an automobile truck, including driver, at $2 per hour for less than 24-hour periods, and $30 per day for 24-hour days. During February it was necessary to operate this truck 20 days of 24 hours each.

The crew consisted of an operator and four utility men, the former being in charge of the work. The maximum number of service connections relieved in any one day was 45, on Feb. 16, 1918.

A flat rate of $5 is paid by the owner of the property if the service connection is frozen between the property line and the building. No charge is made for thawing if the service is frozen between the main and the property line. Of the 886 cases reported, 165 were frozen between the property line and the building, and 721 between the main and the property line.

Setting 25,000 Meters Cut Water Consumption at San Francisco

Two Field Crews Placed ⅝-Inch Meters at Average Labor Cost of $10.59—In Paved Sidewalks Cost for 19,524 Meters Was $11.225 Each and in Unpaved Walks for 5473 Meters $8.65 Apiece

By George W. Pracy
Assistant Superintendent Spring Valley Water Co., San Francisco

During portions of 1916 and 1917 the Spring Valley Water Co., which supplies the city of San Francisco with water, installed 24,993 meters, practically all of ⅝-in. size, with marked effect in reducing water consumption. Careful records of cost were kept. The methods employed, detailed costs and the effect on consumption are shown by the accompanying notes, tables and diagram.

In 1915 the average daily water consumption of San Francisco was 42,635,014 gal., which was in excess of the developed supply and 3,261,229 gal. over that for 1914. As 1915 was the exposition year, with attendant extraordinary water uses, it was confidently expected that 1916 would see a decrease in the use of water. When instead the first four months of that year showed a substantial increase the problem of adding to or restricting waste was squarely put before the company.

On May 1, 1916, water was supplied through 65,000 service connections of which about 22,000, or 34%, were metered. These meters were all on business houses. All dwellings were on a flat-rate basis. The company felt that the metering of these flat-rate services was not only the most economical but also the best way of meeting the situation. Accordingly in May, 1916, an order was placed for 15,000 ⅝-in. meters, with the option of purchasing a second 15,000 at a later date. This option was taken up at the proper time, a total of 30,000 meters being purchased.

For local reasons it was decided to meter only those consumers whose monthly bills were $1.80 or more. This made the work of setting the meters harder and more costly than metering all houses. All meters were set at the curb.

Material—The meter selected was the standard ⅝-in. Trident. Inasmuch as only standard makes of meters were considered, price and delivery were the deciding points in making the selection.

The company intended using none but concrete meter boxes. As these could not be delivered fast enough, cast-iron meter plates were used in cement sidewalks. The concrete boxes were used in lawns. Later, concrete covers were used in concrete sidewalks. The concrete covers made a much better job than the cast-iron covers.

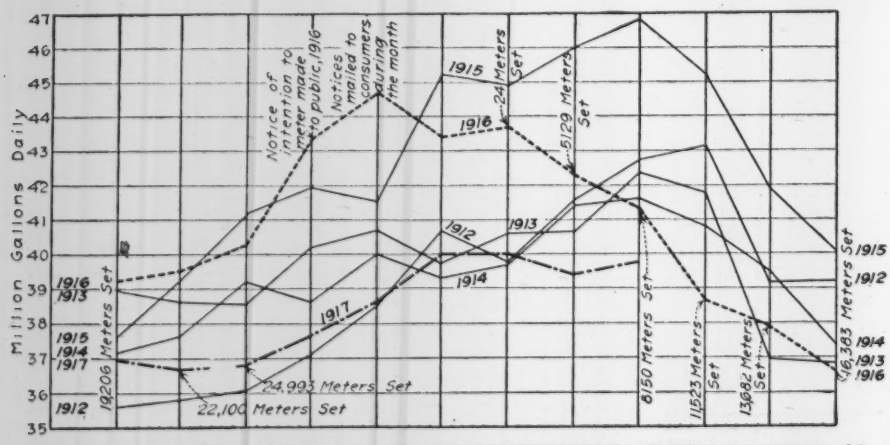
Organization—The field work was done by two crews. For the first month each crew consisted of a foreman and about 30 men. The crews were later cut down to 12 to 15 men. The two foremen were under the general foreman of the service and meter department. A Ford truck and a Ford wagon delivered the meters, boxes and other material on the ground.

Method of Setting—The meters were delivered to the meter shop by the manufacturers. There they were taken out and tested. A testing machine of six-meter capacity was used. Each meter was tested for a 10-cu.-ft. flow at the rate of 15 gal. per minute. Meters reading from 99 to 100% correct were set. Those reading under 99 or over 100% were sent to the bench for adjustment. After testing, the meters were piled up ready for delivery to the job.

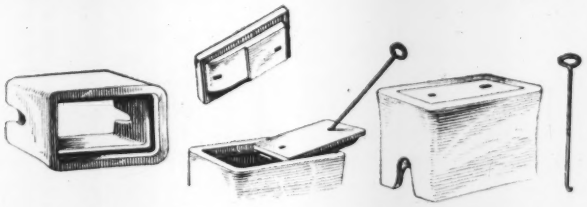
The meter boxes were delivered f.o.b. cars at San Francisco. Thence they were hauled to the yard, where they were stacked. The other material was delivered at the yard by the various manufacturers.

A large tool box mounted on wheels was kept in the locality at which each crew was working. At this tool box was kept about half a day's material for the crew. This enabled the crews to start work at 8 a.m. and continue till the truck arrived.

The Fords were sent out each morning with the material needed for the day. They also moved the tool boxes along as the work progressed. The material was delivered from the tool boxes to the houses by one man using a wheelbarrow. Meter-set orders were written in the main office and given to the general foreman, who routed them and gave them to each gang foreman. The gang foreman in turn had a man who took these orders and went ahead of the crews measuring up and marking out the services that were to be metered. The marking



THE EFFECT ON AVERAGE DAILY WATER CONSUMPTION OF THE ADDITION OF METERS IS SHOWN MONTH BY MONTH THROUGH 1916-17



CONCRETE METER BOXES WERE USED IN LAWNS

was done by chalk on the sidewalk or curb. This man was followed by the laborers, who excavated down to the service and stopcock. If the meter was to be set in the concrete sidewalk a piece about 2 ft. square was first broken out. In lawns the sod was carefully taken out and set aside. The laborers were followed by the servicemen, who set the meter. The servicemen were then followed by other laborers who set the concrete boxes and filled in. In concrete sidewalks the laborers just filled in, the repaving being done by a contractor. A team followed to clean up and haul away the debris.

For each hole made in a paved sidewalk an order was filled out and sent to the paving contractor. This order specified the location, kind of paving and size of opening.

Each serviceman was provided with a pad on which he wrote the number and location of the meter as it was set, using a new sheet for each. These were collected by the foreman, who checked each one and entered the information on the orders. The servicemen could not make the original entry direct into the meter-set orders, as it was necessary to keep them clean. The orders were then sent to the clerk at the yard, who made out the paving orders. They then went to the main office, where an account was opened for each meter.

The speed of the crews varied from day to day, depending on various conditions. In the old part of the town, which was burnt over in the fire of 1906 and where the service records were not always correct and the services in poor condition, the least headway was made. In the new residence districts the work went along rapidly. The crews as a whole averaged 4¼ meters per man per day, though on some days they set as many as 8 per man. Each serviceman set an average of 15 meters a day. A record was kept of the number set by each man, and if any serviceman could not keep up with the rest of the gang he was dropped.

In the old districts the lead services had crystallized and broke very easily when handled. This necessitated frequent repairs with the wet-joint machine. Another trouble was the clogging of sewers by dirt and pieces of concrete as the hole was being excavated. This was overcome by tying a piece of burlap over the sewer vent as soon as the concrete was broken or the sod removed. The paving orders were stamped "SEWER" whenever a sewer vent came inside the broken pavement. This was done after the contractor had paved over several sewers without replacing the sewer plate.

In the lawns the sod was carefully replaced around the meter box. The grass was watered with a solution

TABLE I. AVERAGE COST OF INSTALLING 24,993 ¾-IN. STYLE 2 TRIDENT METERS ON OLD SERVICE CONNECTIONS AT SAN FRANCISCO, CAL., AUG. 1, 1916, TO APRIL 30, 1917 *

		Cost		
		Total	Per Meter	Percentage
1.	Labor	$21,013.84	$0.840	7.90
2.	Teaming	2,088.89	0.083	0.79
3.	Paving	45,488.48	1.820	17.17
4.	Permits	8,934.00	0.357	3.37
5.	Material	180,750.16	7.232	68.30
6.	Tools	1,202.47	0.048	0.45
7.	Miscellaneous	970.96	0.039	0.37
8.	Supt., warehouse, etc	4,354.37	0.170	1.65
		$264,803.17	$10.589	100.00

1. Labor: Sub-Foreman, $4.25. Fitters, $3.75. Laborers, $2.50. Eight hours. Average crew consisted of sub-foreman, five fitters, ten laborers and one Ford. Set about 63 meters per day. Meters set per man day, $4.25.

2. Teaming: Horse-drawn vehicles, $1,238.89. Ford auto trucks, $850.

3. Paving: Replacing sidewalks and setting plates at 25c. per square foot. This charge applies only to 19,524 meters set in sidewalks and becomes, per meter paved, $2.33.

4. Permits: Permit to open paved sidewalks at 50c. each. Applies to meters set in paved sidewalks only at 50c. each.

5. Materials:

24,993 meters f.o.b. yard at $5.95		$149,238.55
Concrete boxes	88	5,197.80
Cast-iron plates	60 and 65	10,677.74
Meter couplings	16 to 19	8,244.27
Pipe and fittings		7,391.80
Total		$180,750.16

6. Tools: New tools purchased, $1,149.39. Tools repaired, $53.08.

7. General:

Miscellaneous	$346.44
Carfares	63.65
Machine shop	114.60
Stationery	186.40
Repair sewer vents	170.83
Clean carpets	27.22
Replace lawns	61.82
Total	$970.96

8. Superintendence, employees, insurance, foreman, yard office (proportion), warehouse expense (proportion), auto (proportion of assistant superintendent's and foreman's and all of two sub-foreman's autos, $4,354.37).

* A few larger meters are included as well as a small amount of street paving due to having to shut off at main in some cases. These amounts are practically negligible.

TABLE II. DETAILED COST OF SETTING A ¾-IN. METER

	Paved Sidewalks	Unpaved Sidewalks
Labor	$0.840 (including testing)	$0.840 (including testing)
Teaming	083	083
Paving	2.330	
Plate	625 Box	880 (including 0.03 handling car to yard)
Permit	500	
Material*	6.590 (including meter)	6.590 (including meter)
Tools	048	048
Miscellaneous	039	039
Superintendent, etc.†	170	170
Total	$11.225	$8.650

* Meter at $5.95 f.o.b., Bryant St. Yard. † Departmental overhead only as far as assistant superintendent.

Approximately 19,524 meters were set in paved sidewalks and 5,473 meters in unpaved sidewalks. In paved sidewalks there occurs a charge for permit to open sidewalk ($0.50), replacing pavement at $0.25 per square foot, amounting in this case to $2.33 per meter paved, and the cost of a cover either concrete or iron varying from $0.60 to $0.65 each, say $0.625. In unpaved sidewalks these costs do not occur, but there is the cost of a concrete meter box ($0.88). In lawn sidewalks the removal and replacement of sod is equivalent to the cost of breaking up concrete walks.

In the following cost segregation only the difference in paving, materials and permits has been taken into consideration.

TABLE III. SEGREGATION OF LABOR COSTS FOR METER SETTING

Hauling concrete boxes and covers from railroad to yard	$27.62
Unloading meters from wagon to warehouse	16.92
Testing meters	542.11
Installation of meters	19,215.74
Replacing lawns and gardens	28.42
Miscellaneous yard work	118.62
Services of clerks	562.09
Repairs to sewers broken in setting meters	238.92
Cleaning out sewers	44.68
Locating services with wireless pipe finder	105.40
Rearranging services	79.74
Machine shop	33.58
Total	$21,013.84

TABLE IV. CLASSIFIED RATES OF PAY AND TIME FOR LABOR USED IN SETTING METERS

	Rate	Days	Hours	Amount
Foreman	$4.25	447		$1,899.75
Fitters	3.75	1,732		6,495.00
Helpers	2.75	230		632.50
	3.00	220	3	661.12
Laborers	2.50	2,347	6	5,869.37
	2.75	1,198	4	3,295.88
Teamsters	3.00	56	2	168.92
	2.75	63	4	174.63
Miscellaneous	4.00	2	3	9.50
	3.50	2	1	7.44
	3.25		4	1.63
Total		6,299	3	$19,215.74

of lawn fertilizer until it regained its original condition. Few lawns had to be resown.

The cost data for the job are given in Tables I to IV. The effect of the meters on the water consumed is shown in the diagram.

The city is now 72% metered. The remaining 18,000 meters will probably be set in the next two or three years.

Water Consumption in Army and Guard Camps Compared

By Dabney H. Maury

Lieutenant-Colonel, Quartermaster Corps, National Army, Construction Division, War Department, Washington, D. C.

WATER consumption at the majority of the 16 National Army camps during the past five months has exceeded the 55 gal. a day per man and animal allowed in the construction specifications, while most of the National Guard camps have kept their consumption down to their allowance of 30 gal. The difference in consumption is largely due to the fact that all the National Army camps have sewerage systems, while only Camp Kearny of the National Guard camps is so provided.

In almost all of the camps the waste was increased as a result of allowing faucets to run to prevent freezing. In a number of National Army camps having central steam-heating plants with no return pipe system, the steam used for heating was blown to waste. In extreme cold weather as much as 600,000 gal. of water per day was wasted through the steam-heating pipes of a camp. The very large per capita consumption at Camp Grant is known to have been due in part to this fact, and in part also to leakage in the underground mains, and especially at the joints between wood-stave pipe and cast-iron pipe or specials.

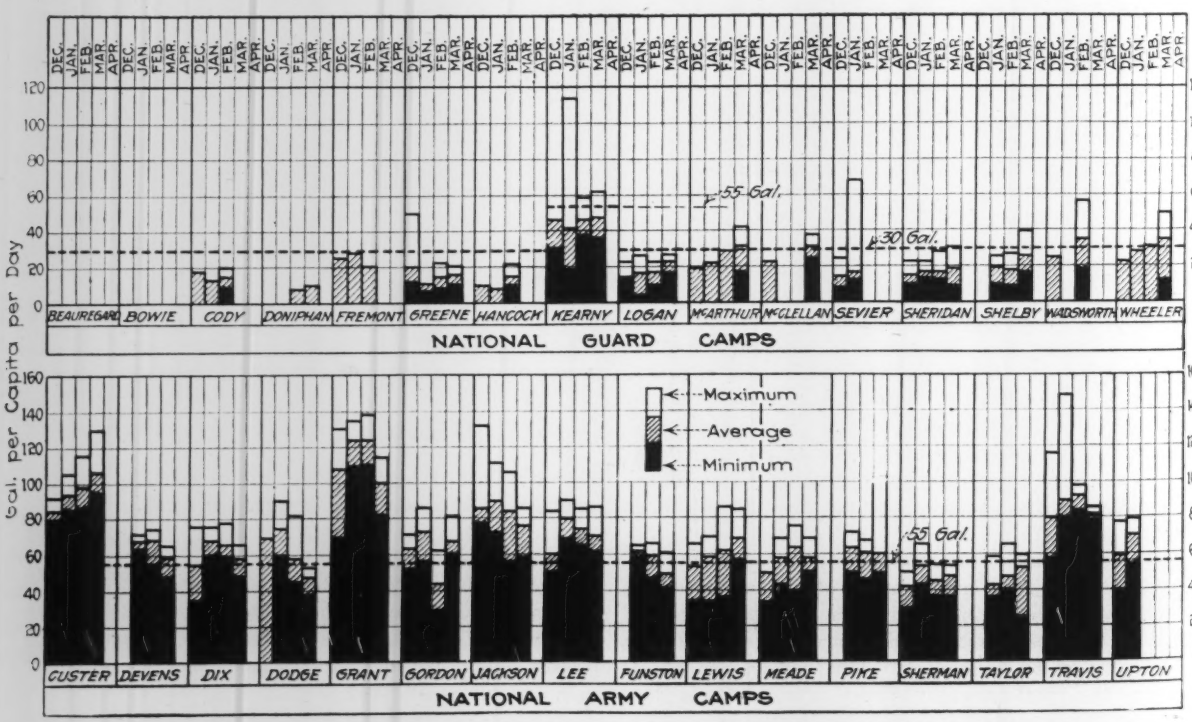
Camps Dodge, Funston, Sherman and Zachary Taylor, of the National Army, and Camp Kearny, of the National Guard camps, are all below their allowance of 55 gal., being all practically tied at between 48 and 52 gal. for the month of March. Camp Custer appears to be at the other end of the list, its average daily per capita consumption during the month of March having exceeded 105 gal., and being still apparently on the increase.

All of the camps have sufficient water for their present uses, but it is, of course, very desirable to avoid waste, especially when, as is the case in many of the camps, the cost of pumping is high. Since the legitimate uses of water may be expected to increase during the hot summer months, it is absolutely necessary that leakage and waste be kept within reasonable limits.

Preparations are now being made to deal with this subject at all of the camps, not only to reduce operating expenses, but—what is far more important—to preserve the efficiency of the fire protection afforded by the water-works systems.

It is interesting to note here that while there have been many fires in the various camps, in only one case has a fire been allowed to spread beyond the building in which it originated, and in this case the fire was confined to one barracks building and one adjacent lavatory building.

The allowances of 30 gal. per capita per day for the guard camps and of 55 gal. per capita per day for the Army camps are very liberal ones, and there is absolutely no reason why these allowances should be exceeded, if reasonable precautions are taken to check leakage and waste.



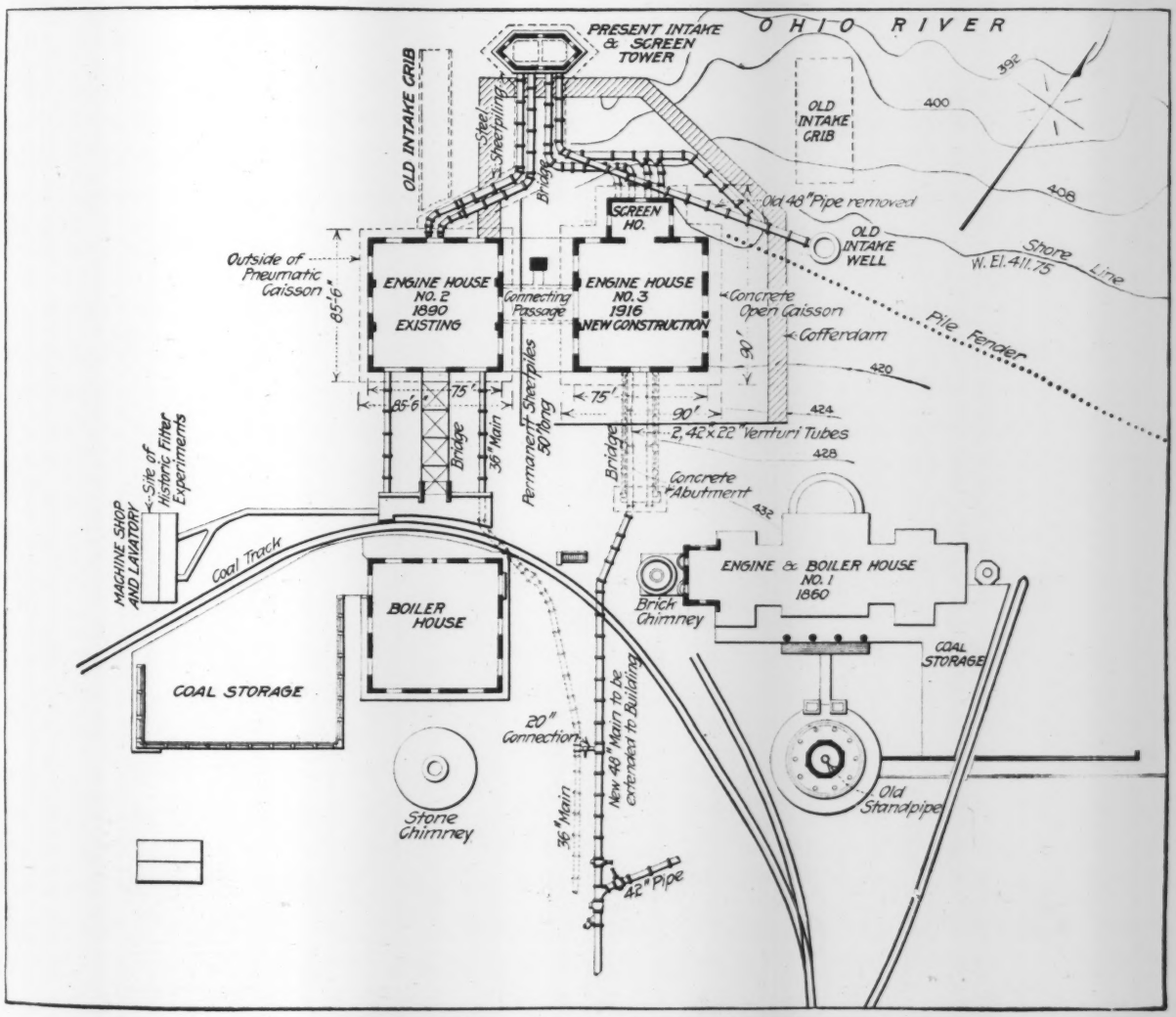
LACK OF SEWERAGE SYSTEMS EXCEPT AT CAMP KEARNY LARGELY EXPLAINS WHY THE LATTER USE LESS WATER THAN THE FORMER

Louisville Builds New Pumping Station on Huge Open-Well Caisson

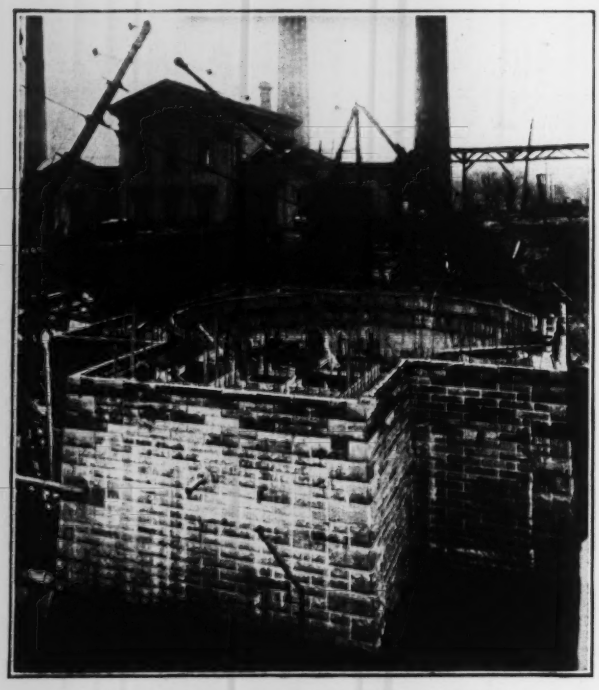
First Foundation of This Type on Ohio River Is Successfully Landed—Alternative Design Included Steel Truss Bracing—Government Gives Priority for Building Engine

SUPPORTING the new 60,000,000-gal. pumping station which Louisville is building for its water-works is a concrete open-well caisson 90 ft. square and 33 ft. deep, containing 5858 cu.yd. of concrete and 145 tons of reinforcing steel. Despite the great size and weight the net resultant pressures are but 2.6 tons per square foot, and the buoyancy at high water is 3.7 tons. No other caisson of similar size of this type has been constructed heretofore along the Ohio River, but the project was put through with success, the caisson being landed last fall almost exactly at the desired depth. On March 18 a priority order was granted to the Louisville Water Co. to contract with the Allis-Chalmers Manufacturing Co. for a 30,000,000-gal. triple-expansion, reciprocating flywheel pumping engine. The 67-ft. circular substructure or dry well resting on the concrete caisson in which it and another engine (the latter in the future) will be placed is now about half completed.

In the layout of the building at this river station the center line of the intake built in 1913 is offset from that of the main pump house No. 2 by 57½ ft. It was desirable therefore from an architectural standpoint to duplicate the outward monumental appearance of the older building and to locate the new building (No. 3) so that the group would be symmetrical about a north-and-south axis passing through the intake. This brought the foundations of stations Nos. 2 and 3 within 27½ ft. of each other and necessitated foundation designs which would preserve absolutely the integrity of the older structure. No reasonable expense was spared, there-



NEW LOUISVILLE ENGINE HOUSE MAKES SYMMETRICAL LAYOUT



LATEST VIEW OF OPEN-WELL CAISSON

fore, in the design of the new foundation, which it was felt should extend to a depth equal to or lower than that of the timber caisson on which the older station rests, as the material is a homogeneous sand and fine gravel having a high bearing power if confined.

Of the three zones making up the structure—caisson, substructure and superstructure—the caisson design and method of construction have features of interest to the builder of deep foundations as well as those interested in water-works. Several tentative designs were made before the one chosen was adopted. One of the first was a steel sheet-pile cofferdam with truss bracing, but the possibility of having to substitute the pneumatic for the open method made a concrete open-dredging well caisson the most desirable. This possibility did not materialize, but it was also a factor in the determination of the size and number of the openings. An even number was chosen to facilitate keeping the caisson level as the material was excavated.

The size was about as large as could be handled by pneumatic means. The octagonal shape of the wells was adopted, instead of the circular form proposed at first, to facilitate the introduction of diagonal reinforcing and simplify to some extent the form work. Another objection to the steel cofferdam and open excavation was that the large amount of steel (833 tons) for the temporary structure would entail too great expense at the prevailing and rising prices. There was also the possibility of a blow-in or sudden movement of material from the outside under the sheet piling, which would endanger and possibly wreck both the old No. 2 station on the west and the original No. 1 station on the south. In any case, the whole caisson must be held together rigidly, for it was assumed that there would be a movement of 6 to 18 in. toward the river under the influence of the high embankment. As a matter of fact, the travel was 15 in. This movement also dictated somewhat the offset of the caisson, as it was quite essential to have the new building line up with the old one.

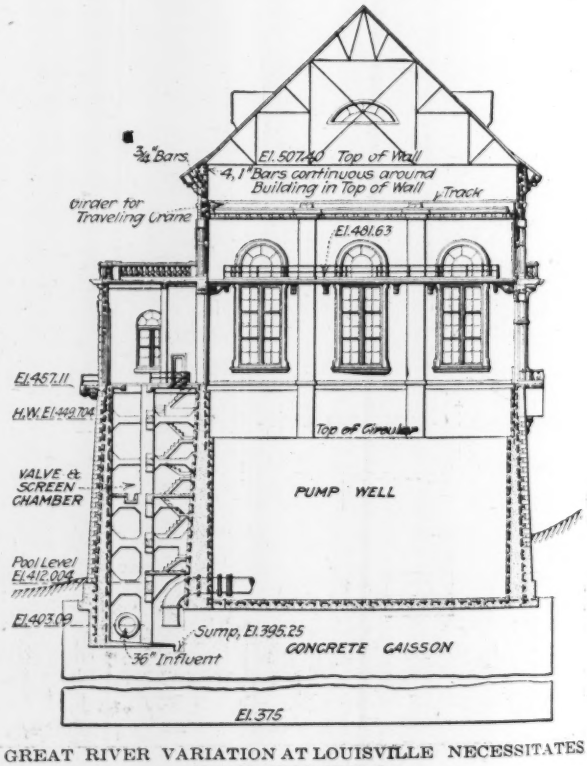
The intermediate division walls acted, of course, as beams to support their own weight when the caisson hung upon the outside cutting edges after the material had been excavated below the intermediate cutting edges. It did hang up in this way several times. When the caisson was within 15 or 18 in. of being landed, the material was excavated to at least 10½ ft. below the inside edges. To land the caisson, jetting under the outside cutting edge was resorted to.

The seals filling the openings were made entirely of concrete, after sand had been dumped in to the level of the interior cutting edges. Some thought was given to a substitution of sand for the lean-mix concrete above the 6-ft. seal proper, which was placed by tremie under water. However, this idea was given up because of the possibility of slight settlement or shifting under pump vibration.

As an added measure of safety against any future concentrated load pushing any one seal down or up, a concrete mat reinforced two ways with 1-in. bars on 18-in. centers was placed over that part of the caisson under the circular pump pit and under the cored-out wells in the four corners. The latter serve only to lighten the load and to save concrete.

All of the cutting edges were riveted together and then secured to the concrete by heavy hook bolts. This made a rigid base of tension steel, and also a lower chord when the caisson hung up on the edges.

Construction was initiated by the driving of 50-ft steel sheet piles around the west and south sides of the site to keep down the water, and particularly to prevent movement of material from areas adjacent to or under

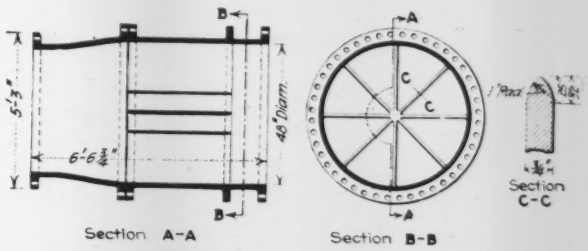


GREAT RIVER VARIATION AT LOUISVILLE NECESSITATES HIGH STRUCTURE

the old buildings. Ground water, coming toward the river, was even more troublesome than anticipated because of the volume and high level. A cofferdam was placed around the river and east sides to enclose the area of operation. This was filled with material excavated from the site and dredged from the river. With a few exceptions, the dam was tight against ordinary river levels, although three units having a combined capacity of 2700 gal. per minute were operated much of the time, particularly when the top of the caisson was below river or ground-water levels. The maximum draw down or difference maintained in elevation between river height and the water inside the cofferdam was 16 feet.

When the river portion of the site had been leveled off and trenches excavated in the sloping bank for setting up the cutting edges, the steel plates were riveted together, the reinforcing was placed and the forms were erected. Before the concrete was deposited, earth was backfilled under the cutting edges up to a point where the truncated pyramidal shape intersected the octagonal shape of the wells. This was to give additional support to the cribwork of short timbers, which was not sufficient to carry the concrete load. A depth of 14 ft. was placed first in three lifts.

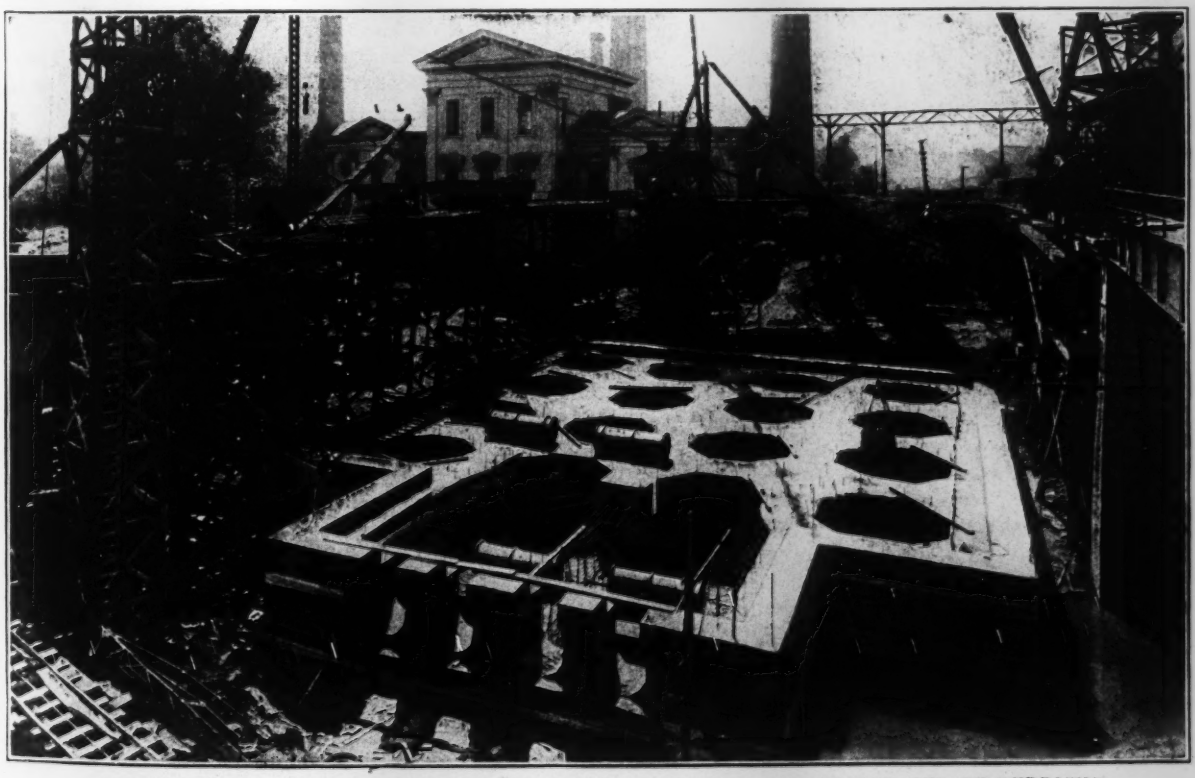
Some sagging took place, but before the final set of the concrete, so that no permanent injury was done and a true monolith was obtained. After 14 days the forms were removed and excavation was begun immediately, the blocking being dredged out as the work proceeded. Thereafter concrete lifts of 8 ft. each alternated with the work of excavation, about 10 days being allowed each time for the concrete to set before excavation was resumed.



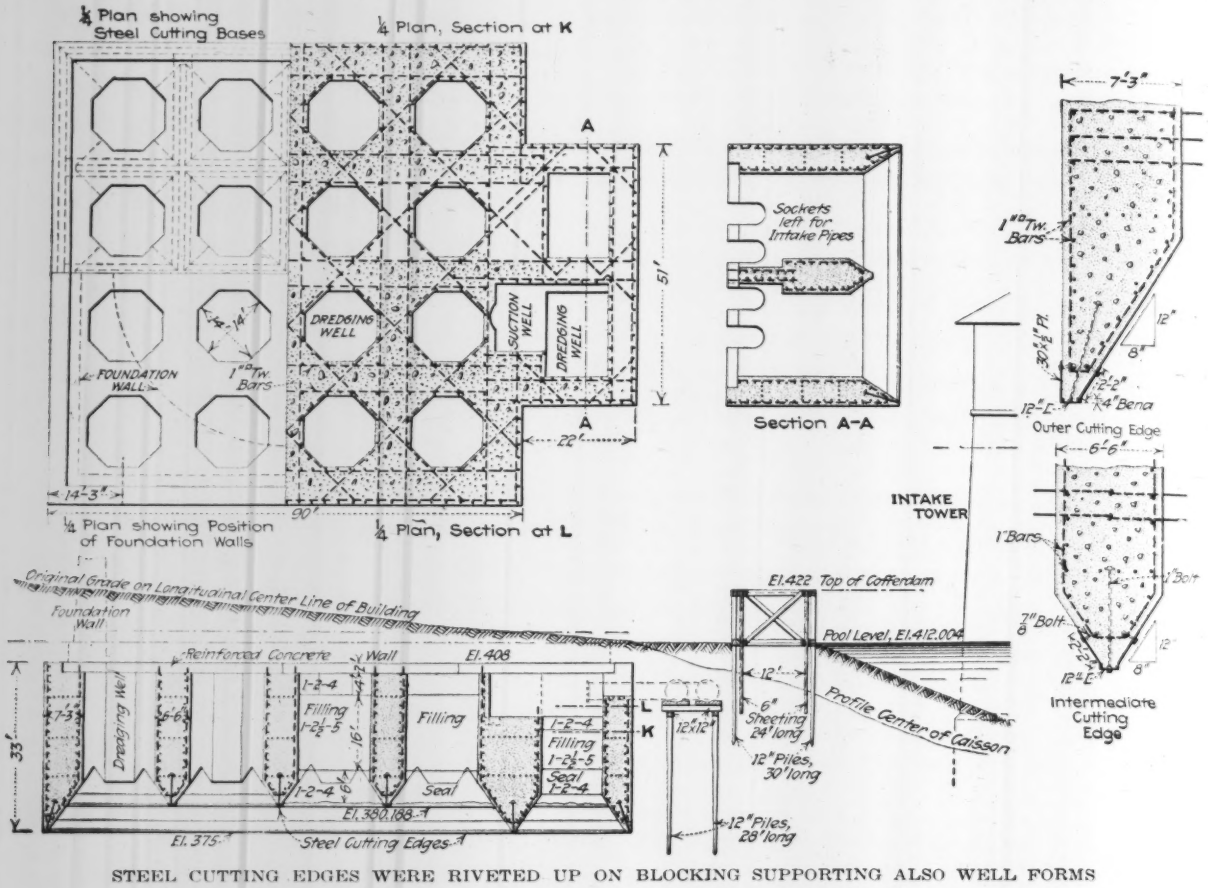
VANES AHEAD OF VENTURI METER TEND TO STRAIGHTEN WATER THREADS

To handle the materials, two derricks and a whirley or revolving crane were set up so as to cover the entire site. The concreting plant, with 100-ft. tower and chute, was placed on one of the river corners of the cofferdam and was supplied with aggregate and cement entirely from barges. Trestles for narrow-gage tracks for the removal of excavated material and to bring in reinforcing bars and other material were built along each side of the structure, just inside the line of sheet piling on the west and the cofferdam on the east. The height of the trestle was about 36 feet.

Following one of the blowouts which occurred when the caisson was within 6 ft. of landing, the trestle on the east moved toward the excavation 7 ft. at the top and 2 ft. at the ground level. The one on the west, which was anchored to the old station by cables, moved about 10 in. at the top. The trestle on the east had to be pulled back 4 ft. by steel cables led to an old pile fender. The one on the west was reinforced by the driving of about eight piles and the shoring up of the decks to approximately the same level as before. Careful measurements were made at all times on the old pumping sta-



CONCRETE OPEN-WELL CAISSON FOR LOUISVILLE PUMPING STATION EXCAVATED BY DERRICKS



STEEL CUTTING EDGES WERE RIVETED UP ON BLOCKING SUPPORTING ALSO WELL FORMS

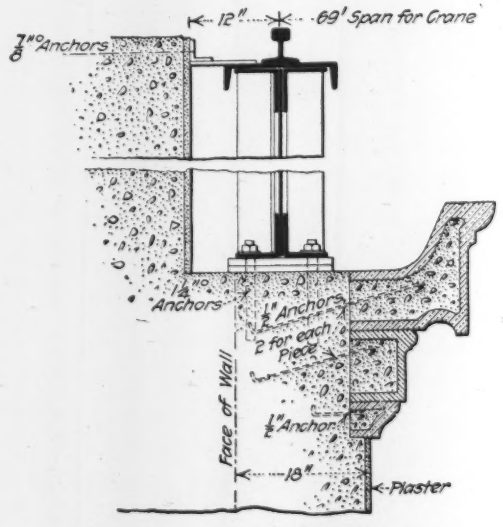
tion, but they indicated absolutely no movement. Two or three times each day levels were taken on the caisson.

It is thought probable that the blowouts, which came from the caisson hanging up and the excavation proceeding ahead of the cutting edges, were caused by the timbers of an old inclined trestle that had been laid down the sloping bank into the river with heavy timbers, some of which, 12 x 24 in., were recovered. Flat cars with boiler and pumping equipment were let down the incline as the water receded. This expedient was used during the transition of intake lines from the old No. 1 station to station No. 2. In one of these experiences the caisson dropped about 12 in. in a few minutes. After a blowout, material was piled on the outside to increase the friction on that side. The rate of sinking could usually be controlled by varying the rapidity of excavation from the different wells. The maximum rate of sinking for any one day's work was 27 inches.

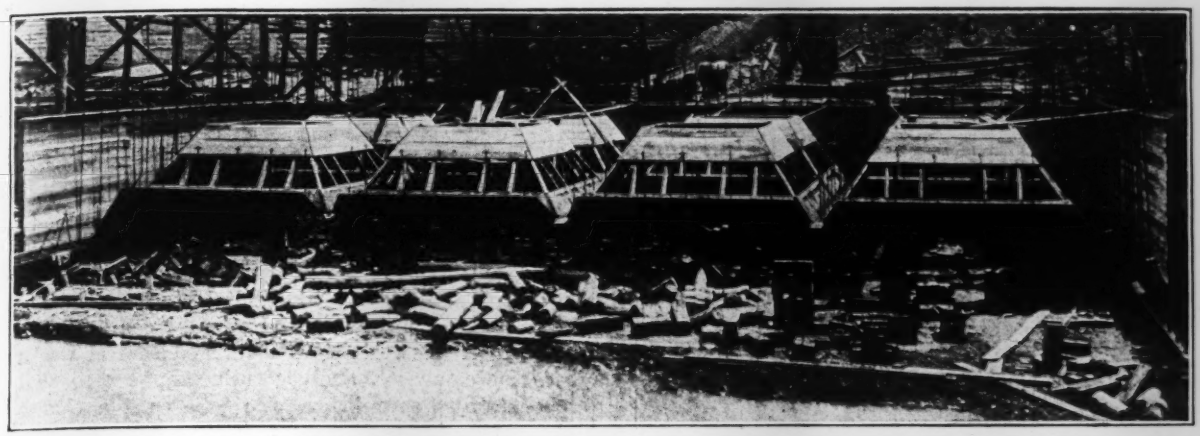
When within 1½ ft. of the final landing, the excavation work was stopped and jetting under the outside was started. Water under 70 lb. pressure was used, the jetting pipe being lowered in each outside well and worked up and down under the whole length of the outside cutting edge. The caisson now rests within ¼ in. of the desired level, the river edge being ⅜ in. too high and the bank edge ½ in. too low. The river edge, contrary to expectations, was always high. Whether this was due to encountering more of the old trestle, or to the greater height of the ground water on the bank side, has not been determined.

In the design of the substructure and superstructure the same outward appearance of ashlar masonry as in the old station was carried out. In the new structure, however, the masonry is only a veneer covering reinforced concrete.

The circular engine pit in the substructure provides horizontal arches to withstand a maximum head from high water of 41 ft. No wood is used in the building,



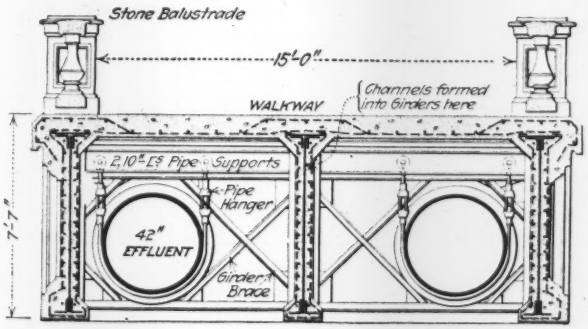
TERRA COTTA HIDES CRANE GIRDER



CONCRETE OPEN CAISSON HAS OCTAGONAL DREDGING WELLS

the red tile roof being supported on steel trusses and the ¼-in. plate-glass windows set in steel sash.

There is a steel balcony at the ground-floor level, and a heavy terra-cotta cornice hides the crane girders, which rest on pilasters in the east and west walls. The ends of these girders are built into the north and south walls, and where they rest on pilasters they are anchored by vertical anchors in the usual way. Their tops are



BRIDGE SUPPORTS PIPE BELOW WALKWAY

braced against the wall with steel diaphragms and are anchored to the wall by hook bolts embedded in the concrete.

In the building of the substructure the ashlar courses were carried up 4 or 5 ft., the circular reinforcing was placed and the inside form sheets were erected on top of previously placed forms. To prevent cement stains from penetrating the stone facing, the latter was painted (except on the exposed surface) with a coat of stone backing. This limestone is a dark brown color when quarried, due to a small amount of oil, but eventually the oil leaches out and leaves the stone white.

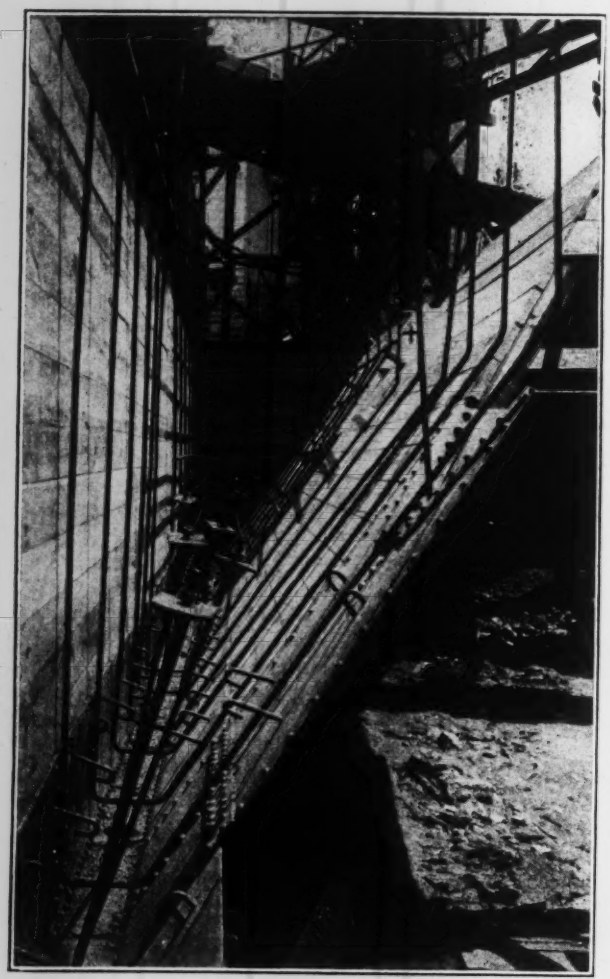
On the river side is a combined valve and screen chamber in the main engine-room floor level, on which are located the lockers, lavatories, general stores and change quarters. Stresses due to water pressure are transmitted to the main structure through the partitions.

All valves are double-disk gate valves rather than sluice gates. Each of the two 48-in. lines from the intake branches just before entering the chamber into two 36-in. lines, thus spreading out the water over the screens and making smaller units to handle.

A double line of flat screens of ½-in. mesh made of No. 8 wire may be raised to remove débris and to wash it to a cleaning floor. This floor is at an intermediate elevation 17.2 ft. below high water, for the highest stages do not last more than three or four days, and if cleaning should be necessary during that time it can be done at the main floor level. Velocities provided for through one set of screens at a 30,000,000-gal. rate and low water are 25% of the 3.7 ft. per sec. provided for in the pipes. This chamber was built up in lifts simultaneously with the main structure.

Connection with the old station will be effected by a covered passageway consisting of two plate girders faced with concrete panels and supporting three cross diaphragms and a concrete slab, on which are built

DECK OVER CAISSON IS REINFORCED ONLY UNDER CIRCULAR ENGINE PIT AND CORE WALLS IN CORNERS



STEEL PLATES AND ANGLES CONNECT OUTSIDE AND INTERMEDIATE CUTTING EDGES

hollow-tile walls faced with stone, the whole being covered with a concrete slab roof. Connection is made with the embankment by a bridge of three girders supporting the two 42-in. discharge pipes from the station. The bridge is under the concrete walk, thus hiding the pipes from view, whereas in the old station they are suspended from rod trusses. Venturi meters are to be placed under this bridge. As there will not be much opportunity for the water threads to straighten out before entering the meter, vanes are placed in the wall casting immediately in advance of the meter tube.

The construction of the pumping station is being carried out by the Fruin-Colnon Contracting Co. and the Missouri Valley Bridge & Iron Co. A. L. Hupe is engineer in charge of construction and design, working under the general direction of James B. Wilson, chief engineer of the Louisville Water Company.

Roots Fill 20-Inch Sewer Pipe

Poplar tree roots penetrated the joints of 20-in. storm sewers at Wilmington, N. C., stopping the free flow of water and in some cases breaking the terra cotta pipe. In most cases it was necessary, according to J. E. Holton, superintendent of streets, to cut down the trees to avoid trouble.

Table for Estimating Water-Main Extension Costs

By Allen F. Brewer

Estimator, American International Shipbuilding Corporation, Merion Station, Penn.

With current rates for materials and labor fluctuating as they are today, it is of inestimable value to the water-works engineer to be able to calculate to a fair degree of accuracy the probable cost of any extension of mains he may have in view. More than ever is it necessary that unit costs be calculated for each particular extension. No longer can he safely judge that if a certain 4-in. main laid several weeks ago cost 60c. a foot, another such can be estimated at about that figure today. To take such a chance might result in a disastrous investment, especially where the number of customers to be served is limited.

The accompanying table shows how such an itemized calculation for unit costs of water mains may be prepared. The figures quoted are of course not based on current prices, but have been assumed arbitrarily, merely to serve as an example.

Such a tabular estimate is of much value where affirmative action is required of a State Public Utility Commission before the company may legally charge for water supplied by any new extension. It will lessen the work of the commission's valuation engineers markedly, usually doing away with all investigation on their part except for a cursory check of the data submitted.

TABLE SHOWING MANNER OF DERIVING UNIT COSTS OF ITEMS INVOLVED IN WATER-MAIN EXTENSIONS

Item and Description	Size of Pipe in Inches: 4	6	8	10	12
Material:					
Weight per foot, lb.	19.33	30.25	42.08	55.91	73.83
Cost of pipe per ton, f.o.b. siding	$27.50	$26.00	$25.50	$25.25	$25.25
Cost of specials at 3% of cost of pipe	.83	.78	.77	.76	.76
Total cost, pipe and specials, per ton	28.33	26.78	26.27	26.01	26.01
Carting from cars to trench at $1.00 per ton	1.00	1.00	1.00	1.00	1.00
Cost per ton, delivered	29.33	27.78	27.27	27.01	27.01
Cost per foot, delivered	.284	.420	.573	.755	.998
Joint material (lead and cement), per jt.	$0.300	$0.500	$0.700	$0.900	$1.100
Joint material as above, plus 5% for extras	.315	.525	.735	.945	1.155
Joint material as above, per foot (1-12 of above)	.026	.044	.061	.079	.096
Misc. material (blocks, fuel, etc.), per ft.	$0.002	$0.002	$0.003	$0.003	$0.004
Total material, per ft.	$0.312	$0.466	$0.637	$0.837	$1.098
Storeroom expense (3% of material cost)	.009	.014	.019	.025	.033
Total material cost	$0.321	$0.480	$0.656	$0.862	$1.131
Labor:					
Average width of trench, ft.	1.5	1.66	1.75	1.83	2.0
Total depth of trench, ft.	3.42	3.57	3.75	3.91	4.08
Contents of trench per foot, cu.ft.	5.13	5.95	6.57	7.17	8.16
Contents of trench per foot, cu.yd.	.19	.22	.243	.265	.303
Trenching and backfilling (at 60c. per yd.), per ft.	.114	.132	.146	.159	.182
Laying, calking, setting valves, etc.	.023	.027	.030	.035	.040
Total, labor laying pipe	$0.137	$0.159	$0.176	$0.194	$0.222
Tools, carting, lost time, overhead, etc. (10% of above)	$0.014	$0.016	$0.018	$0.019	$0.022
Total labor cost	$0.151	$0.175	$0.194	$0.213	$0.244
Total labor and material costs, per ft	$0.472	$0.655	$0.850	$1.075	$1.375

Railways File Field Surveys of Water-Supplies in Texas

Meet U. S. Public Health Service Rule Covering Water Served by Common Carriers—Special Form Used

By Raymond G. Upton

First Lieutenant, Medical Corps., U. S. N. A.; Lately Assistant Sanitary Engineer, Texas State Board of Health, Austin

By A recent ruling the U. S. Public Health Service requires a field survey of water-supplies to be made and certified along with the certificates of analysis of the waters which are furnished to common carriers for drinking and culinary purposes. No definition of what this field survey shall consist of is given. In order to arrive at some standard, and also to furnish a permanent record, the Bureau of Sanitary Engineering of the Texas State Board of Health has worked out a form by which field surveys are being made. Division engineers of the railroads and other competent persons are authorized to make the sanitary inspections and to make reports to the State Board of Health on the blank forms furnished to them. These reports are filed as a permanent record and certificates are made out in accordance with them. Only men of recognized ability have been in charge of the work, and good results have been obtained.

Many reports indicate possible sources of contamination. In such cases steps have been taken to have the necessary improvements made. Most owners of water-supplies are glad to be informed concerning defects in their systems, if such exist, and splendid coöperation in making the necessary improvements has uniformly resulted.

In most cases where waters have not been approved on the basis of the field survey the analytical results have also shown contamination. The blank form used to record the results of these surveys is submitted herewith.

As stated, the field survey is now required of the railways. It is hoped that its use by municipalities will also be made compulsory.

TEXAS STATE BOARD OF HEALTH, AUSTIN, TEXAS
BUREAU OF SANITARY ENGINEERING

Certificate of Field Survey of Water for Water Supplied on Cars, Vessels, Vehicles, or Other Conveyances by Persons, Firms, or Corporations Engaging in Interstate Traffic

This is to certify that a field survey has been made this.....
day of.....191....of the source or sources of the water
supplied to.....(name of carrier).....
at.....(station or port).....
from.....(hydrant, well, cistern or tank).....
of....(name of owner; if private supply give exact location)....
for drinking and culinary purposes on cars, vessels, vehicles, or
other conveyances of the aforesaid carrier.....
Field survey made by.....Division Engineer
of the.....

Below follows the report of the field survey made by the Division Engineer of the interstate or intrastate carrier which is applying to the State Health Officer of Texas for certification of water furnished for drinking or culinary purposes on cars, vessels, vehicles, or other conveyances of the aforesaid carrier.

Certificates may be revoked at any time by the State Health Officer, should the conditions be found contrary to the statements below or otherwise unsatisfactory upon inspection by an inspector duly appointed by the State Health Officer. All drawings or sketches shall be furnished on 11 x 8½-in. tracing cloth and three blueprints of same shall be furnished, together with the report given below.

If source of supply is well, what is its depth.....
How high does water rise in the casing.....Size of casing.....
Kind of casing.....Kind of pump used.....
Capacity of well in gallons per hour.....
May oil, surface drainage or seepage enter the well (make careful examination and report fully).....
.....
What is the character of the soil.....Of soil or rock below the surface.....
Is the well fed entirely by artesian water.....
Is the well fed by both surface and artesian water.....
Is the well fed entirely by surface water.....
Is water furnished raw or treated.....How treated.....
If water is not supplied from a well what is its source.....
Is it furnished raw or treated.....Describe treatment and plant used.....
If chemicals are used how much and what kind.....

Make drawing on letter size tracing cloth, indicating on same well, pump house, treatment plant, and intake pipes from reservoir or river. Also indicate all closets not connected to an approved sewer system, all cesspools, standing water, rivers or branches, horse, cow, and hog lots and barns, cemeteries, incinerators, dumping grounds, slaughter houses, bathing beaches, pleasure resorts, parks, schools, and factory or laundry discharging waste any of which are adjacent to the river or lake from which the supply is taken. Also indicate distances. Indicate any other likely source of contamination located at a greater distance. Tracing and blueprints must be furnished.

If water is stored in standpipe or reservoir give capacity, height, and structure.....
Is tank open or covered.....How many gallons used from it daily .....May any surface contamination or rain water enter the tank or reservoir.....(answer fully).....
Are pipe lines and reservoirs ever cleaned and flushed.....
In cases of emergency may water be pumped into reservoir or service lines from other source.....If so describe fully.....
.....
What is your opinion of the desirability of this water for drinking purposes.....

Signed.....
Div. Engineer, R. R. Co.
.....
P. O. Address

Water Meter Program at Philadelphia

Beginning in May water meters must be set on all new connections to the Philadelphia waterworks, in accordance with an ordinance recently adopted by the city council. Sentiment in favor of universal metering within a reasonable time is growing. As recently as Apr. 15, the executive council of the Board of Trade unanimously adopted a report favoring waste curtailment in view of the water shortage last winter and advocating the introduction of meters where possible. Similar action has been taken by committees of the Chamber of Commerce.

According to information supplied to *Engineering News-Record* by C. E. Doris, chief of the Bureau of Water, there are about 70,000 water meters installed in Philadelphia. These were practically all manufacturing plants, business houses, saloons and other large water users, besides many dwellings.

Property owners are required to pay for meters. The minimum charges for metered water supplied through ferrules of various sizes and the quantities which these charges cover are as follows:

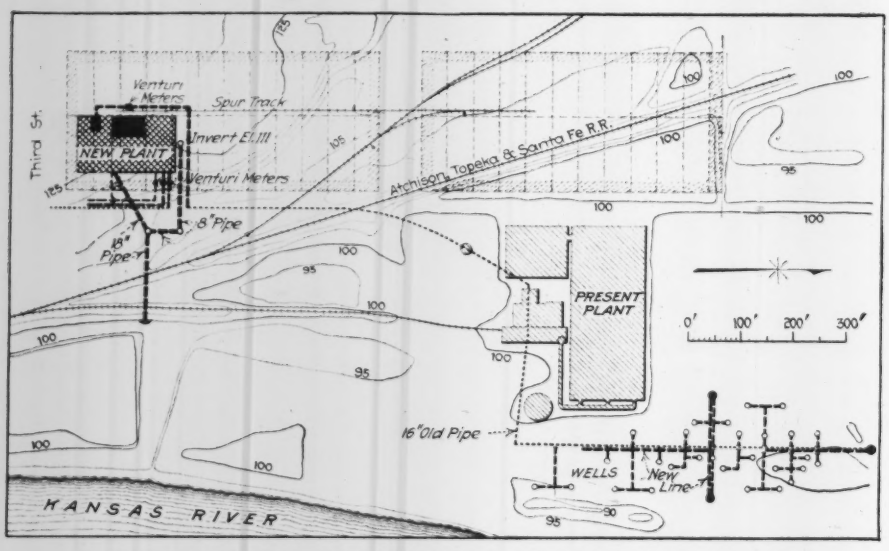
Size of Ferrule, In.	Minimum Charge	Cu.Ft. Allowed
¾	$8	8,000
1	12	12,000
1½	18	18,000
1*	32	32,000
1½	50	50,000
1¾	75	75,000
2	130	130,000
3	290	290,000
4	515	515,000
6	1,150	1,150,000

It will be noted that those using up to the allowed amount get water for $1 per 1000 cu.ft. The charge for all water above the quantities stated is 40c. per 1000 cubic feet.

Coal Pre-Filter Prevents Sand Accretion in Final Rapid Water Filters

Rehabilitation of Former Private Water-Works at Lawrence, Kan., Involves Increased Supply From Wells, Complete Purification Plant for Iron and Hardness Removal

SAND incrustation will be reduced to a minimum, in the water softening plant nearing completion at Lawrence, Kan., by interposing a roughing pre-filter just after the treatment in the settling basins and before the coagulant application for the final rapid filters. Improvements at Lawrence, a city of 15,000 persons, include practically revamping the whole system, as a long tedious controversy with a private company over purchase by the city had led to a bad state of repair. It was almost imperative to remove the iron, ranging from 8 to 15 p.p.m., and to reduce the hardness, which is practically all carbonate. Wells, 60 ft. deep and 16 ft. in diameter, situated along the Kansas River above the city, supplied an insufficient amount of water. The city is growing rapidly, and must supply a student population of 3000 at the State University and the Haskell Indian School. In consequence, improvements on a large scale were initiated in 1916. Black & Veatch, consulting engineers, Kansas City, Mo., were put in charge. An extensive study of all municipal water softening plants was made, with a trip to each to note operation problems. As sand accretion seemed so serious, an attempt was made in the design to overcome this difficulty by means of the pre-filters. Other features in the plant include a gravity aërator, a dry-lime mixer, an under drained, flat-bottomed settling basin, anthracite coal or chats in a pre-filter, and a nonmetal Wheeler bottom final filter.

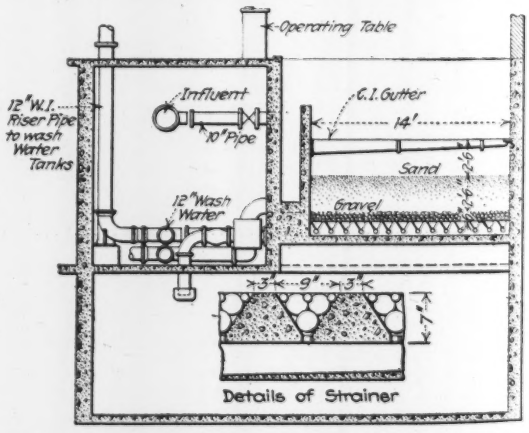


THE NEW WATER-WORKS PLANT AT LAWRENCE, KAN., WAS PUT ALONGSIDE THE OLD ONE

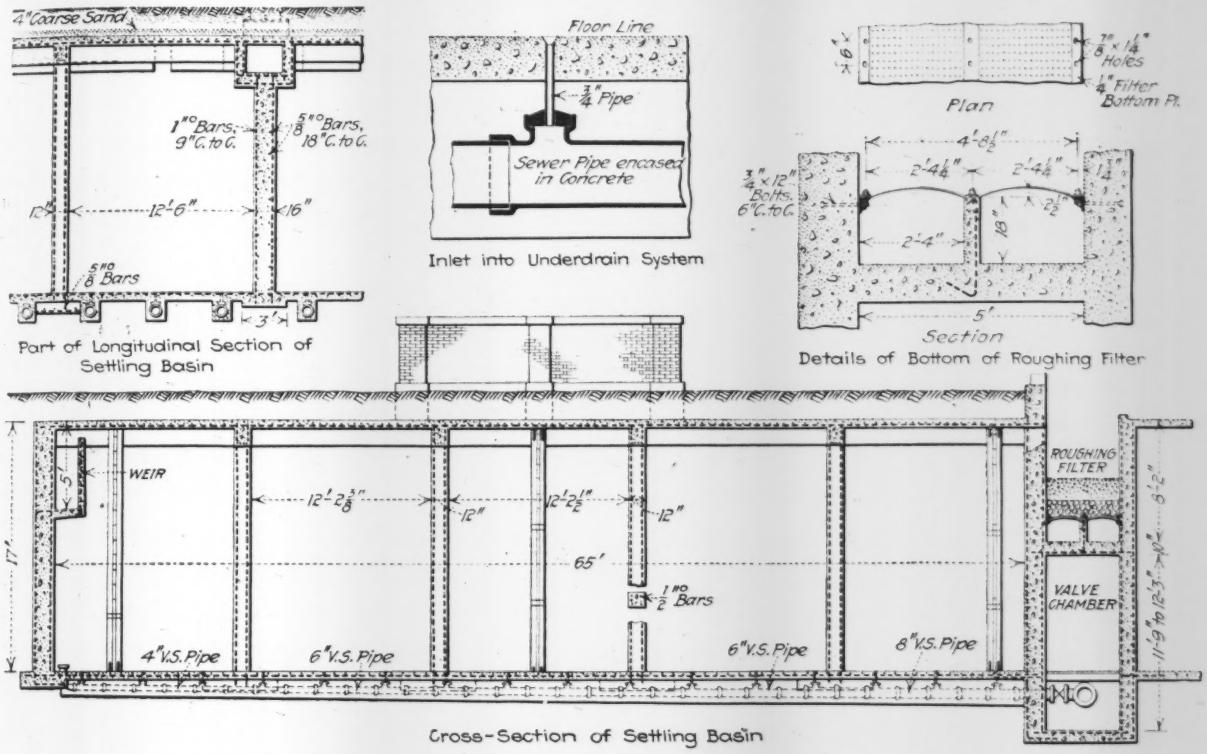
On account of the location near the wells the old plant was subject to inundation to a depth of 13 ft. in extreme floods. It was decided, therefore, to build a new pumping station on high ground, ½ mile from the wells; to increase their capacity by driving additional well points in the bottom and new well points in a horizontal direction through the concrete walls; also to drill a new 24-in. well with a screen extending entirely through the water bearing strata. The alternative was to use the non ferrous river water at about the same expense, but a strong feeling against the river water existed and the city officials, in connection with a citizens' advisory committee, decided it was unwise to change supplies at this time. Connections are left, however, so that the change can be made, if ever desired, at a minimum expense.

The aërator used is of a type first devised by the engineers for a plant at Excelsior Springs, Mo., where it has been successful in the oxidation of the iron and in the removal of CO_2. Elimination of the latter is especially desired at Lawrence. The principal feature is the small amount of head required.

Lime is fed by a special mixer designed roughly by the consulting engineers and perfected by the New York Continental Jewell Filtration Co., which has the equipment contract. The idea was to get a dry-feed machine which would regulate as accurately as liquid fed through an orifice. The apparatus was first designed for Emporia, Kan., and has worked satisfactorily. It will feed from 5 to 20 grains per gallon when the plant is operating at a maximum of 2100 gal. per min., equivalent to a rate of 2 gal. per square foot per minute, or 125,000,000 gal. per acre per day.



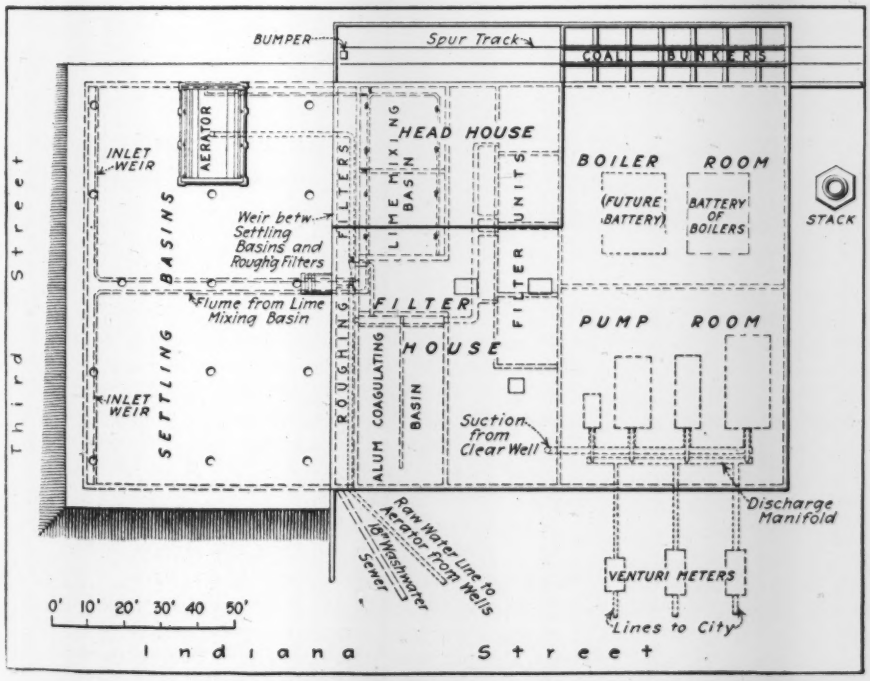
FINAL FILTER HAS WHEELER UNDER-DRAINS WITH NO METAL



SETTLING BASIN AND ROUGHING FILTER HAVE INTERESTING DETAILS

A retention period of one hour is provided in lime-mixing basins where the water is mechanically agitated as it passes these basins either in series or parallel. A variation in time required for the different seasons of the year is anticipated.

A concrete flume carries the water to the settling basin from the filter building and distributes it across the ends of the two basins, where it has a detention period of six hours. Collection is over a combined weir and division wall between one basin and the pre-filter. Mechanical agitators stir the water in the lime-mixing basin as it enters and just as it leaves. Coagulant may be applied at either point. To control the depth of sludge and to keep the basins in continuous operation underdrains, consisting of vitrified pipe incased in concrete, with ¾-in. openings, 4½ ft. c. to c., lead to a cast-iron manifold with valve control on each line of sewers. The sewers are each controlled by quick-operating valves. The manifold discharges into the gallery under the pre-filter, from which it is drawn off to the sewer or to a pump which returns the sludge to the incoming water. No slope is given to the floor, as previous experience indicated a ridged floor difficult to construct. The cost and trouble were considered unwarranted because the sludge will build up its own angle of repose. Provided also the basin is cleaned frequently enough to avoid

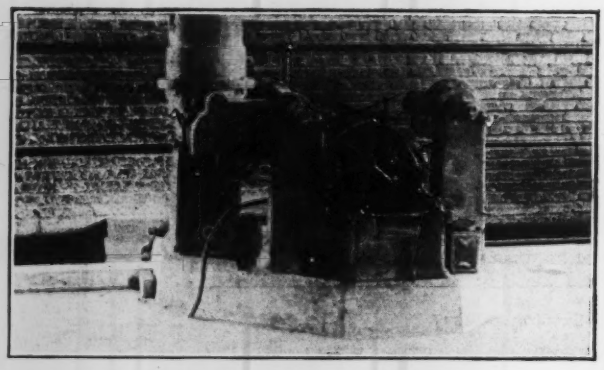


LAYOUT OF NEW PUMPING STATION AND WATER TREATMENT PLANT AT LAWRENCE, KANSAS, MAY BE STUDIED

hardening, there seemed to the designers no reason why the residual amount of sludge which would always be in the basin would cause any trouble. Covers over these basins will prevent algæ growths and maintain the low temperature of the well water. It will also improve the appearance of the plant.

For the pre-filters an 18-in. layer of anthracite coal or Joplin chats is to be used over 14 in. of gravel. As this is somewhat of an experiment, one filter will have coal similar to that used at Dallas, Tex., and the other chats. If the latter material proves to be satisfactory it is preferred, because of its availability and lower cost.

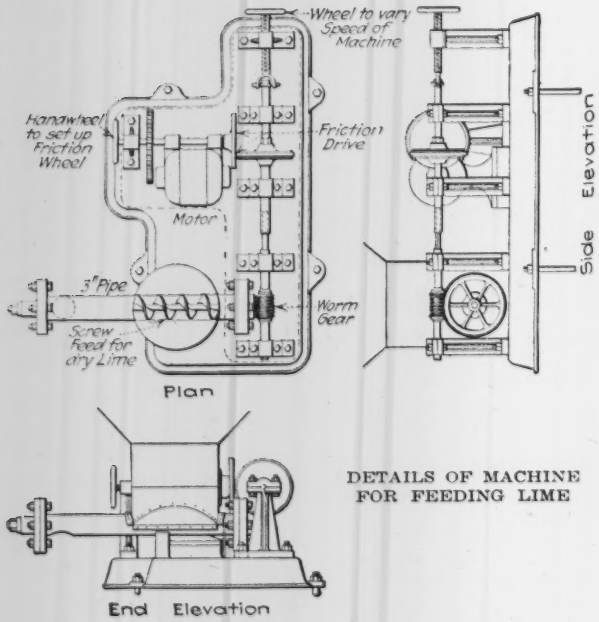
The steel-plate underdrains with ⅜-in. holes 6 in. c. to c. are designed for a high-velocity wash. The filter-



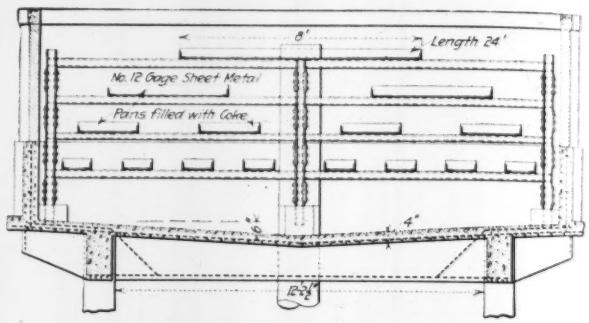
COMPACT MACHINE FEEDS DRY LIME TO WATER

ing rate is 4 gal. per square foot per minute, twice that of the final filters.

No special features are embodied in the mechanical filters, other than the Wheeler underdrains, as it is desired to eliminate entirely any metal in the strainer-system. An alum-mixing basin has a 1-hour detention capacity. Hydraulically operated valves are controlled from tables. The clear well is below the filters and pipe gallery.



DETAILS OF MACHINE FOR FEEDING LIME



AERATOR OPERATES UNDER LOW HEAD

Wash-water tanks of wood, situated on the third floor of the headhouse, were chosen after considering a concrete tank on a tower and steel tanks. Wood was selected because of its present availability and lower cost. The tanks can be replaced easily at a later date without tearing down the building. The difficulty of getting a bottle-tight concrete tank and the unsightliness of such a tank if it leaks were arguments against building a tower tank.

To avoid discoloration of the front wall of the building, which might occur from seepage through the concrete walls of the alum-mixing basin, which is back of the south portion of the east wall of the main building, a drained opening is left between the concrete and the brick wall.

In the construction a railway track was laid to the site and the contractor built first the coal bunkers, subsequently using them for storing concrete materials. All concrete was deposited from a central tower and chuting system, supplied by a gravity mixer.

The Kansas Paving & Construction Co. is the general contractor for the work. Black & Veatch, Kansas City, are consulting engineers for the city and have as their resident engineer C. I. Dodd. The work is under the general direction of E. H. Dunmire, city engineer.

Fill Forms Pit for Submerged Coal Storage

To store a reserve supply of coal under water the Iowa Railway & Light Co. has formed a basin by enclosing low land along a stream near its power plant at Cedar Rapids, Iowa. The railway crosses on a fill 15 ft. high. Another fill between this and the higher ground makes a basin 460 x 130 ft., with an average depth of 15 ft., and capacity for about 20,000 tons of coal. The sandy top stratum was removed, leaving a bottom of hardpan upon which the coal is dumped. Three concrete trestles carry tracks across the pit. Coal cars on these are unloaded by dumping or by means of an electric locomotive crane with grab bucket. This crane serves to reclaim the coal as needed, loading it into hopper-bottom cars which dump into the coal hopper at the power station.

A centrifugal pump belted to an electric motor is provided for filling the basin from the stream, a small dam being built to insure a sufficient supply. Water is delivered to the basin through two 4-in. iron pipes. It has not been considered necessary to line the fills, as they are practically watertight. The work was done under the direction of J. M. Drabelle, electrical engineer of the company, at a cost of approximately $25,000.

Electrification of Pumping Stations Saves Coal and Money

Philadelphia Water Bureau Combines Several Small Pumping, Power and Lighting Loads at One of Its Smaller Pumping and Filtration Plants and Saves 4000 Tons of Coal a Year to Help Win War

By Harrison R. Cady
Mechanical Engineer, Bureau of Water, Philadelphia

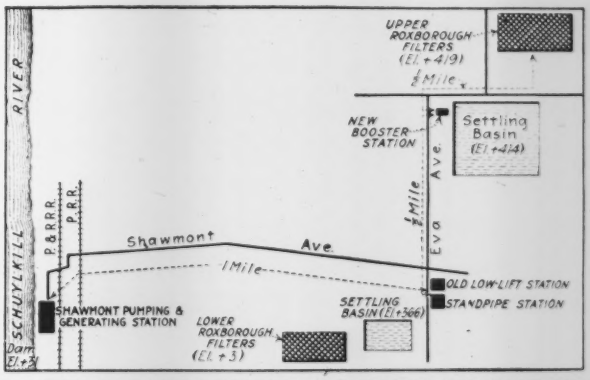
ELECTRIFICATION of the Roxborough pumping stations of the Shawmont-Roxborough filtration system, one of the smaller divisions of the Philadelphia water-supply, shows the trend of up-to-date practice in water-works installations. By combining several small pumping, power and lighting loads, and centralizing the work of boiler equipment, it was found possible to reduce fuel consumption more than 70% and to effect a very considerable reduction in operation and maintenance costs. In this period, when fuel conservation is of such vital importance, probably the outstanding feature of this project is the annual saving of about 4000 tons of coal. There are, however, various engineering problems and features which apply as readily to industrial plants and are as typical of them as of modern water-works service.

Raw water from the Schuylkill River is pumped to settling basins, filtered and distributed. Part of the distribution is by gravity and the remainder, in high elevation areas, by direct pumpage against standpipe pressure. The lower filters are fed from their settling basin by gravity, but since the upper filters are about 5 ft. above basin level their supply must be repumped. An average of 24,500,000 gal. per 24 hours is filtered, of which the upper filters handle about 14,000,000 gal. The standpipe pumpage averages 3,500,000 gallons.

Standpipe pumpage and the low lift of raw water to the upper filters were handled by the Roxborough pumping plant which was, in effect, two separate stations having steam-driven pumps supplied by a common boiler plant. Incidentally, it is of interest to note that the location of the low-lift station at this place, where a common boiler plant could be utilized, was an attempt at centralization and had some of its advantages, but entailed the use of over 4000 ft. of main doubling on itself and producing a head of more than twice that required to feed the filters through a reasonably direct line. The combined stations, however, did not constitute a plant of sufficient size for economical independent operation from the standpoint of either fuel or labor, and in addition to this the fuel cost was increased over 20% by a difficult haul. As a central generating station the advantages of the Shawmont pumping station were: A convenient railroad siding from which coal was conveyed direct to bunkers and an existing boiler load of 1200 to 1600 hp. Also, due to the recent installation of modern pumps and stokers, there was sufficient building capacity for generating equipment, and the additional boiler load was so small a percentage of the total as to have no effect on boiler room operation other than a small increase in fuel consumed.

The electric system, which is now nearly completed and is in partial operation, carries the standpipe and low-lift pumpage and in addition furnishes power for lighting all buildings and for filter-wash pumps, sponge washer, coal conveyor, machine shop and various other auxiliary work.

The Shawmont generator equipment consists of three 187.5 ky.-a. direct-connected turbo alternaters running at 3600 r.p.m. and generating 60-cycle, 3-phase current



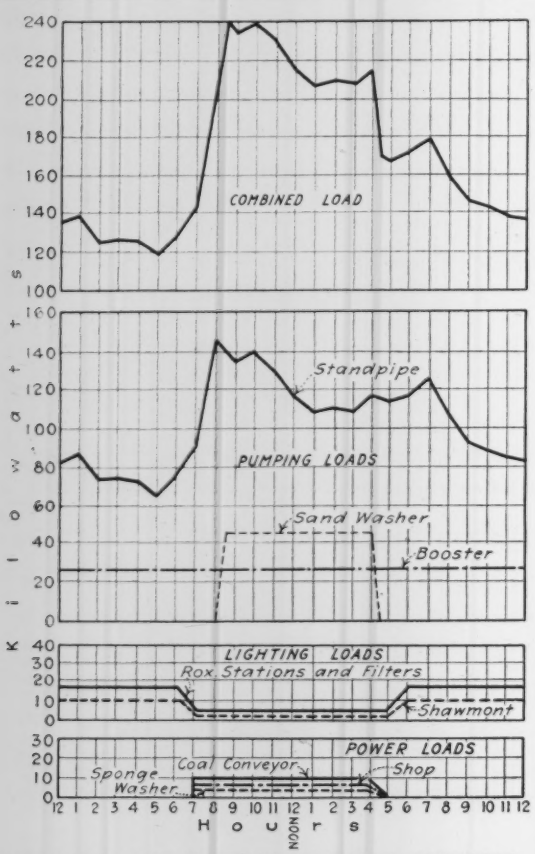
GENERATING AND MAIN PUMPING STATION IS LOCATED AT RIVER BELOW PURIFICATION WORKS

at 2300 volts. Turbines are designed for condensing operation. For Shawmont lighting and auxiliary load, current is stepped down to 115 volts. An underground conduit line extending along Shawmont Ave. and Eva St. carries lead-sheathed transmission cables to the standpipe station and to the new low-lift or booster station, where current is stepped down to 220 volts for both lighting and power service.

The standpipe pumping equipment consists of two 6,000,000-gal. and two 3,500,000-gal. pumps, direct connected to 150- and 75-hp. motors, respectively. The booster pumping equipment consists of two 15,000,000- and one 7,500,000-gal. centrifugal pump connected to 40- and 25-hp. motors, respectively, through reduction gears. These motors are all of the wound-rotor slip-ring induction type, with variable speeds in ten steps actuated from drum controllers. This speed range gives capacities down to half normal under the practically constant heads required.

A typical generator load curve for 24 hours and the principal component loads are shown by the accompanying diagrams. Since standpipe head is practically constant, the curve for that load also shows the variation in water consumption. Of these various loads the standpipe pumpage is the service which demands absolutely continuous operation of the system, since an interruption of more than 15 min. might have serious results in case of a fire in the district served by standpipe pressure.

This necessity for continuous service and the high



COMBINED AND COMPONENT LOADS COMPOSED

cost of public service standby has made certain special features of plant design advisable. Briefly, these "insurance" features consist of steam lines so connected as to give generator turbines an independent line to individual boilers in case of trouble in engine-room steam mains or boiler room header; two sources of condenser water-supply and relief for noncondensing operation; two independent transmission cables; and ample reserve in generator, transformer and pumping units.

There are several angles from which the question of costs and investment returns may be considered in connection with this system. Considering it strictly as a substitution of the new system for the old, there is a net saving, allowing an interest and depreciation charge of 12%, on the $100,000 invested, of $7000 per year under pre-war coal prices, or $13,500 per year under 1917 coal prices. This comparison, however, is hardly fair to the new system, since no allowance is made for the fact that the old equipment had depreciated to a condition where large expenditure was necessary to bring it to a point of reasonable dependability.

Considering the generator and transmission end only, in order to arrive at a generally accepted basis of comparison, the actual operation and maintenance costs and an interest and depreciation charge of 12% on the $55,000 invested would make the cost of power delivered at the station switchboards about 1.15c. per kw.-hr. under pre-war coal prices, or about 1.52c. under 1917 coal prices. A division of boiler-room labor cost and general overhead and superintendence costs on a horsepower basis would increase these figures by about 0.03c. per kilowatt-hour.

Heavy Motor Truck Traffic on Lincoln Highway

Dirt Roads Requiring Extraordinary Maintenance—Pennsylvania Road Department Takes Three-Day Census

A TRAFFIC census taken recently by S. W. Jackson, assistant engineer of District 13, Pennsylvania State Highway Department, is interesting as an indication of the punishment endured by some roads through the present period of transportation congestion. The most interesting point selected was on State Highway route No. 204 at Darlington, Beaver Co., Penn., an earth road which has almost bottomless depths when the frost comes out in the spring, and which yields very slowly to treatment. It connects with the Lincoln Highway at Rochester, and is traversed by nearly all the new cars and trucks passing overland from Toledo and Detroit to Pittsburgh and eastern points along the Lincoln Highway.

Between 7 a.m. and 9 p.m. on the days of the census the count showed the following results:

	Teams		Pleasure Cars		Trucks	
Date	One-Horse	Two-Horse	Run-about	5-7 Passenger	1-3 Ton	5-6 Ton
March 21....	29	34	78	367	128	34
March 22....	26	20	90	280	106	43
March 23....	45	32	102	392	93	23

Over 95% of the cars and trucks were new and in transit, east bound. In most cases, where new commercial trucks without bodies are in transit from the factories, each truck driven carries a second truck loaded on the chassis. It happened that no United States war truck trains passed over the road when the census was taken, but such trains are being brought over this road almost daily. The writer recently saw four truck trains of 32 trucks each, in addition to officers' cars, pass over the road in one day. A majority of the trucks were each loaded with an officer's car in crate.

While there have been many days with much heavier traffic than that shown above, these figures probably represent a fair average for this road during the past two months. Under such traffic it requires considerable work and material to keep the 12 miles of dirt road passable under all weather conditions. It has been necessary for the State Highway Department to keep a fleet of six to eight 5-ton motor trucks on the work of hauling materials, and during the past eight weeks the department has hauled and placed daily from 100 to 200 tons of blast-furnace slag.

In many cases, especially when the frost was coming out of the ground, from 15 to 20 in. of slag was required to furnish a surface sufficiently stable to support the heavy traffic. This work is being rushed and will be continued until such time as arrangements can be made to divert the traffic and improve the road permanently.

Pipe-Testing Apparatus Saved Both Water and Time

Wood Drum with Metal Head and Hose Connections Used to Test 42-in. Reinforced-Concrete Pipe at Seattle Water-Works

By T. H. Carver
Assistant Engineer in Charge of Water-Supply, Seattle, Wash.

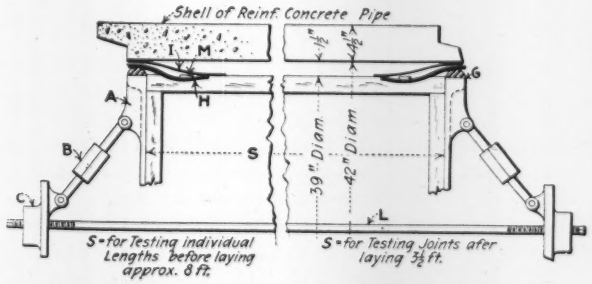
In testing some 42-in. reinforced-concrete pipe for the water-works of Seattle, Wash., the apparatus by the accompanying drawing and view proved a success, as a saver of both time and of water.

The apparatus consisted of a wooden drum *K*, covered with sheet iron. The outside diameter of the drum was 39 in., leaving a 1½-in. annular water space between the drum and the inside of the pipe. Each end of the drum was provided with a testing head consisting of eight sliding cast-iron plates *A*, expanding rods with turnbuckles *B*, central cast-iron spiders *C* and tension rod *L*. Rod *L* was provided with a right-hand thread on one end and a left-hand thread on the other end. The spiders were correspondingly threaded.

Around the circumference of the expanding plates *A* there was laid a 1¼-in. semi-circular soft rubber gasket *G* vulcanized into one continuous length. A soft rubber sheet *H* was wrapped around this gasket, projecting back far enough on the drum to be cinched down tight by the steel band *M* recessed into the drum surface as shown. Over all of this was wrapped a protecting sheet of heavy canvas 18 in. wide tacked to the drum along the inner edge.

The working pressure on the pipes varied from 17 to 39 lb. per square inch. The test requirements, according to the specifications, were as follows:

Hydrostatic Test: Each section of pipe, after having been kept in storage for the period elsewhere specified, shall be subjected to test. The ends of each section of pipe shall be closed by water-tight bulkheads. The pipe shall then be filled with water and the pressure thereof raised to 1½ times the maximum working pressure for which it is designed. The pipe must be absolutely free from fractures during this test. The contractor shall furnish all bulkheads and testing apparatus of every kind and all labor for making testings without extra compensation above the price bid for concrete pipe. Testing apparatus shall be subject to approval by the city engineer.

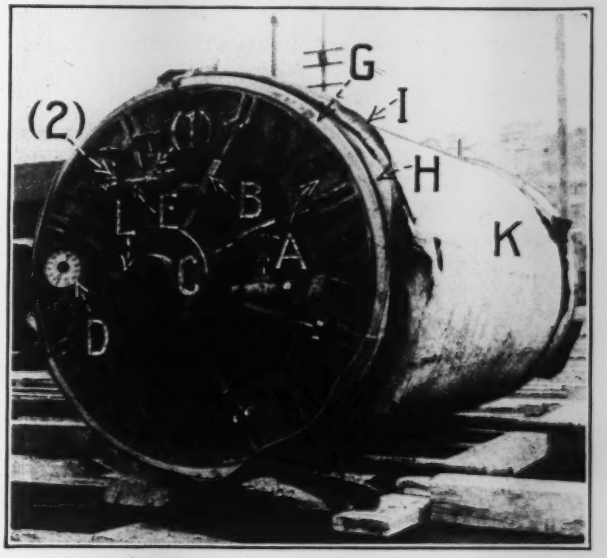


APPARATUS CONSISTED OF A WOODEN DRUM AND METAL HEAD

For separate pipe length, s = about 8 ft.; for joints in trench, about 3½ ft.

Field Test: After the pipe has been laid in the trench, it must be plugged at the end and tested with hydrostatic pressure in convenient sections of such length as the city engineer may direct, to 1½ times the pressure to which it will be subject under the natural working conditions when in operation, etc.

O. C. Little, superintendent for the contractor, after some experimenting developed the apparatus described for the hydrostatic tests and it was accepted by the city engineer as satisfactory. After the pipe laying had begun he was permitted to use the same apparatus for the field tests, but since in this case it was only necessary to test the joints between consecutive lengths it was made only 3½ ft. long. This also reduced the weight and facilitated moving from joint to joint.



THE TESTING HEAD HAD SIX SLIDING CAST-IRON PLATES

In adjusting the apparatus for a test, the tension rod *L* was turned, screwing the spiders *C* together. The movement of the spiders by means of rods *B* forced the sliding plates *A* outwardly and pressed gasket *G* against the inside of the concrete pipe. This made a water-tight annular space between the outside of the drum and the inside of the pipe. Any irregularity in the pipe was taken up with turnbuckles on rods *B*. Hose connections were made at valves *E* and *F*. Valve *F* was opened, valve 1 at *E* was closed, valve 2 opened. Connection *E* terminated at the top of drum. As soon as water appeared at 2, indicating that all air had been forced out of the annular ring, valve 2 was closed, valve 1 was opened and two ¾-in. hose maintained the pressure through *f* and *e* during the test. The sheet-iron covering of *K* did not have soldered seams, and thus permitted some leakage. It was consequently found that two hose were necessary to maintain the test pressure against this leakage. *D* was an ordinary pressure gage.

In both tests the test pressure was maintained for five minutes and considered satisfactory if no leaks occurred within that time.

Three men were able to test 32 lengths of pipe sep-

arately in 8 hours. In testing laid pipe, 14 joints were the average tested in the same time.

The work was done under the direction of the engineering department of the City of Seattle. A. H. Dimock is city engineer and T. H. Carver is assistant engineer in charge of water-supply.

Meters Help But Are Not Sufficient To Control Waste

Unhampered Officials Holding Strictly to Rigid Observance of Water Ordinances Brings Results

ANNUAL waste surveys, maintenance of meters, rigid collection of high bills caused by fixture leakage, education of consumers and absolute backing by the higher municipal authorities in addition to complete meterage of a water system are factors to which the officials of Oak Park, Ill., ascribe their continued success in controlling water waste. Absolutely no water is delivered free of charge. The metered services include watering troughs, drinking fountains, parks, street sprinklers and hydrants when used for other than fire purposes; and the municipality pays for water used by all its departments. In 1913 the average daily consumption with a population of 26,000 was 1,950,000 gal. In 1917 the population was 35,000, yet the daily consumption was only 2,366,000 gal. During this period the number of meters in service increased from 5799 to 7683. Oak Park has always been 100% metered. In four years, then, although the population has increased 34.6% and the number of services 32.5%, the increase in average daily consumption is only 21.3%. This means that the per capita daily consumption has been reduced from 75 to 67.6 gal. or 9.9%. Of the water pumped last year 84% was accounted for by meters.

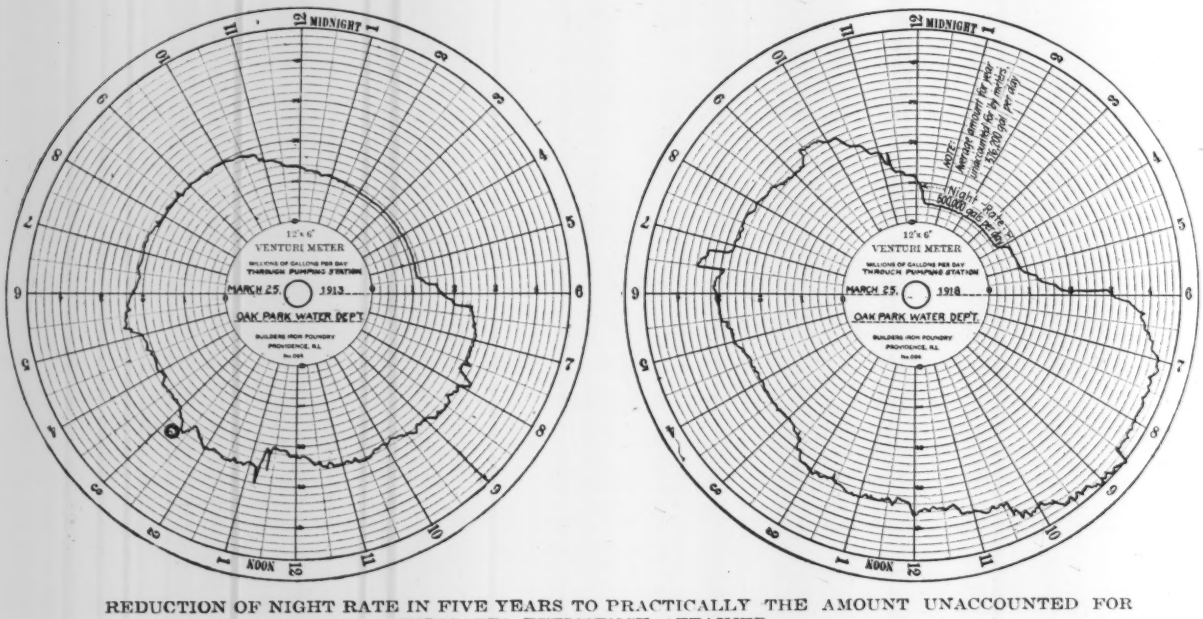
Water is purchased from Chicago at a rate of 6.27c. per 1000 gal. The revenue from the sale of water, on the total quantity pumped, including leakage, is 13.71c. Per capita in 1917 the consumption was 67.6 gal. and per meter it was 308 gal. The minimum night rate was 500,000 gal., which is equivalent to 14.3 gal. per capita, 65.1 gal. per meter and 5750 gal. per mile of mains. The total revenue per meter exclusive of hydrant rental was $15.83, while the total operation and maintenance cost was $12.58. Per 1000 gal. consumed, including water unaccounted for, these figures were 14.1c. and 11.2c. respectively. Plant cost, interest and depreciation do not enter into these items.

The meters are read every three months in a continuous reading system, for which purpose the city is divided into six districts. All meters which the meter readers find stopped are removed, repaired and set back within a week. Periodical tests of all meters in service are rigidly made at 5-year intervals.

Waste surveys are made annually in order to locate the leaks which have developed during the winter. Best results have been obtained by covering the entire system roughly by the pitometer on large districts, and then finishing up on the subdivisions block by block by means of the fire-hose-and-hydrant method.

In connection with waste elimination every one of the 900 fire hydrants is inspected twice a year.

During 1917 the stoppage of invisible underground leakage totaled 250,000 gal. per day. This meant a direct saving of $5000 in the cost of water for the year, in addition to postponing the need of installing auxiliary



REDUCTION OF NIGHT RATE IN FIVE YEARS TO PRACTICALLY THE AMOUNT UNACCOUNTED FOR INDICATES EFFICIENCY ATTAINED

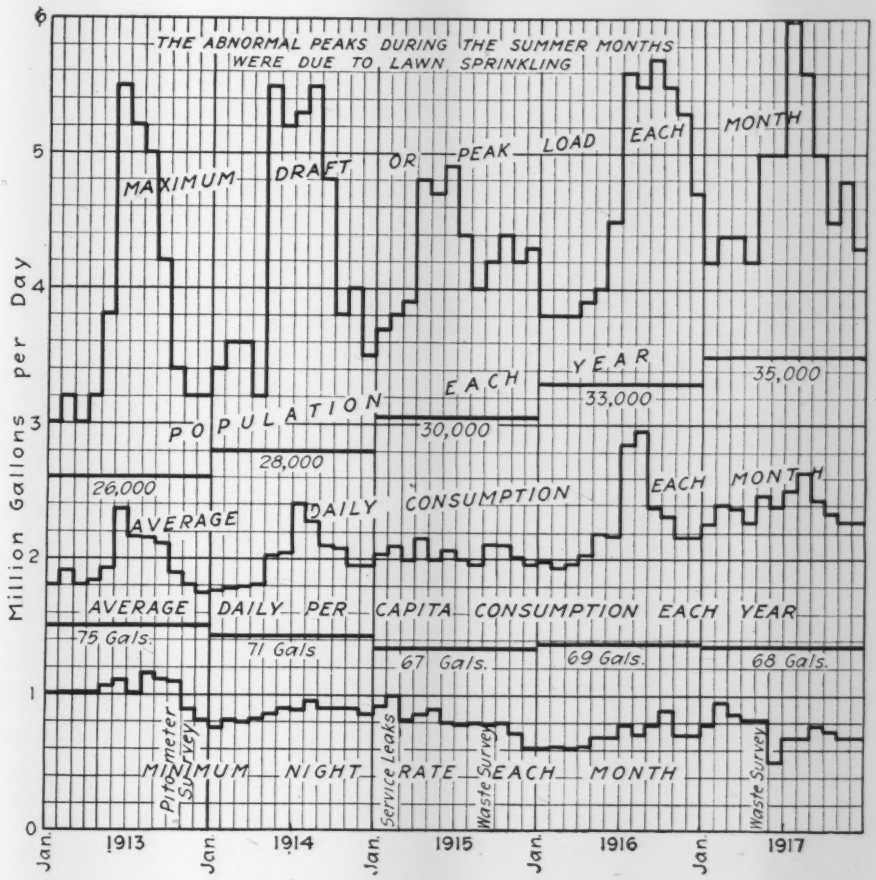
WATER DISTRIBUTION IN OAK PARK

Class	Gal. per Day	% of Total	Per Capita Per Diem
Industrial	235,900	9.97	6.74
Commercial	131,000	5.55	3.75
Public	100,000	4.23	2.85
Domestic	1,498,000	63.30	42.80
*Sewer flushing	22,700	0.96	0.65
*Fires	2,200	0.09	0.06
Unaccounted for	376,200	15.90	10.75
	2,366,000	100.00	67.60

* Estimate from recording venturi meter on discharge of pumps.

pumps to take care of the peak loads. This was a tangible saving. During the four years since 1913, $15,000 has been saved in the cost of water.

In the matter of complaints regarding high water bills, it has been found that leniency encourages waste. Although the complainant is given the benefit of the doubt from the first, because of the fact that it is recognized that mistakes can be made in several ways, the high bill will stand if it is clearly proved that the water was actually consumed whether "used" or not. In the case of underground leakage when the motor is located in the parkway, and there is no negligence on the part of the consumer, the lowest legal rate per thousand gallons is allowed, although the consumption may not be sufficient to come under that head in the schedule. Admonitions are printed on the backs of the water bills, explaining the effect of slight leakage, methods of detecting it, cost of leakage at the ordinary domestic pressure for different size of streams and the policy of the department regarding leakage and waste, so that it is assumed that "he who runs may read." Experience with the water department and its policy of fairness and inflexibility has been found to work wonders, so that unnecessary consumption has decreased generally and the annual number of complaints on account of high bills have been reduced from 2000 to 600. In fact the public with only a few exceptions has been coöperating with the management. The engineer of the water department affirms that although the foregoing policies have proved successful, they would for the most part have been impossible of achievement were it not for the fact that the principal authorities of the city have consistently backed the officials who deal directly with the people.



HOW THE WATER STATISTICS IN A 100% METERED CITY REFLECT THE VIGILANCE PRACTICED

It has been found in many instances that through inherited suspicion of all public officials, the consequence of inflexible impartiality has been destructive criticism and unjust accusation. This has been the case when no one on various occasions has been able to find a "right" person higher up in order to obtain special favors such as the reduction of "unjust bills." It is particularly "irritating" for a prosperous looking and apparently influential citizen with all kinds of bank references to be required to pay the $5 deposit which is demanded of all renters of property who intend to pay water bills. He is told that in order to interpret this ordinance fairly everyone must be treated alike, and that the water will not be turned on until the deposit is paid. It is hard to convince this experienced and sophisticated would-be customer that the department makes no exceptions and that the laws are followed to the letter. He feels sure that were he known and had friends on the "board" he would not be "held up."

Threats have often been made against "arbitrary clerks" who, knowing that they will have full support from the powers that be, will do their duty without hesitation. Embellished stories of discourtesy and "German" efficiency have been written to board members. However, fortunately for the water department morale, both sides of the stories are always heard before a decision is made, and owing to a complete card index of complaints, including all calls of whatever nature for the past five years, the distorted tales are invariably disproved. This sport of interfering with the operation of the water department has not proved profitable and at the present time very little difficulty is experienced in enforcing the provisions of the ordinance.

Collection of bills is the principal bugbear of the efficient water department manager. In Oak Park it is customary for tenants rather than for owners to pay water bills. The proximity to Chicago makes it easy for a considerable number of irresponsible con-

sumers to disappear and leave unpaid bills. The $5 deposit is a good security, but it is found that many persons will move away without claiming the deposit and allow other tenants to occupy the premises without notifying the water department. Notices which are mailed 30 days after the rendering of the bills bring in a goodly portion of the delinquents, but there is a class which does not pay until forced to. This type of customer is often satisfied that all is well if he can pay the bill to the inspector who calls to shut off the water for non-payment. He is willing to repeat the process every quarter.

Oak Park, however, has found that it pays to shut off the water first and then refuse to take the payment of the bill unless the dollar penalty is collected with it. Very few "dead beats" want to pay that dollar twice, and many try to avoid it the first time by appealing to some one "higher up" with stories of injustice, first offense, etc. But the case is dropped when records of previous notices sent to the customer, calls made in the past under the old system of leniency, and his rank in the class of "poor pays" are brought out.

Many consumers who leave the city owing unpaid water bills return after a year or so to find that the water-supply is shut off from the house which they intend to occupy. They make application for water and discover that they cannot get it until they pay all old bills. This is made possible by the elaborate though practical card system and rating of water takers. The result of this vigilance has been the reduction in the delinquent accounts which apparently cannot be collected from $900 in 1914 to $300 in 1917.

H. P. T. Matte is engineer of the water department, reporting to W. F. Sargent, commissioner of public works.

Port Enlargement Active at Mobile

Gulf City Has One Municipal and Two Railway Terminals Under Way Besides Construction of Large Shipyard

MOBILE, Ala., is an exception among the smaller coast cities of the Atlantic and Gulf States in that it is actually starting the construction of a number of port terminals and is enlarging its harbor facilities to take care of the increase of ocean trade the next few years surely will bring. Work has been started on a municipal pier project to cost about $600,000, and two railroads have appropriated a considerable amount of money for the enlargement of their local harbor terminals. The Federal Government is contributing its share by an appropriation of $1,100,000 for deepening the ship channel to 30 ft. from the city to the lower bay.

Bond Issue Voted for Improvement

A $600,000 bond issue covering the municipal improvement was voted by the city some time ago. Pursuant to the instructions received from the voters, the city has started on a municipal dock project which has for its present central feature the construction of a long pier located within the city limits on Mobile Bay and about 3½ miles south of the present municipal wharves. Around this pier it is expected to build up a municipal water terminal, future work to include drainage, railroad connections and the construction of warehouses. A contract has just been let to the firm of Chesley, Earl & Heinbach, of Buffalo, N. Y., for approximately $300,000 for the construction of a timber frame bulkhead within which will be placed a fill to form the pier, the fill to be made from material dredged from the main Government channel, which is about a mile and a half from the shore line and from nearby berths.

The shoreward bulkhead will form a section of new-made land about 1700 ft. parallel to the shore and extending out about 2500 ft. Reaching out from one end of this land will be the 300-ft. pier, about 5800 ft. long, bringing the outshore end of the new pier section 8300 ft. from the shore. This will leave an area of space available for warehouses and other important improvements of 5800 x 300 ft. and 2500 x 1700 ft. It is proposed to dredge in front of the bulkheads to a depth and width suitable for ocean-going vessels. The present depth is only about 5 ft. and the dredging contemplated gives a depth of 30 ft., material from which will be added to the Government dredging to make the main fill.

The railroad terminal will be undertaken by the Gulf, Mobile and Northern R.R. Co. and the Mobile & Ohio R.R. The former plans the construction of three piers and large terminal facilities to cost in all about $1,000,000. The latter is rebuilding its grain elevator and an old pier. The new railway terminal is in the same general district as the proposed municipal work.

A large shipyard, built by a subsidiary of the United States Steel Corporation, is to be added to the two yards already in the Mobile district, one the yard of the Kelly-Atkinson Construction Co. of Chicago, where work is in progress for Government ships, the other that of the Alabama Dry Dock & Shipbuilding Co., which also has government contracts and which is putting up a 10,000-ton dry dock.

The large shipyard for the Chickasaw Shipbuilding Co., the subsidiary of the United States Steel Corporation, is building about 8 miles north of Mobile on the Mobile River. Here on a tract comprising 12,000 or more acres, construction is now going on, mainly in the way of putting up buildings to house the shipbuilders. An interesting feature of the new plant is its location on a waterway which permits the barging of the steel needed in its operations down the Warrior and Mobile rivers from the Steel Corporation's furnaces at Birmingham. The details of the plant itself have not yet reached a stage where much publicity can be given to them.

Searles Lake Potash Lands Opened

The Searles Lake, California, deposit, recognized as a large and available source of commercial potash, has been opened by recent action of the Department of Interior and two plants are manufacturing potash from this source at present. Saturated brine deposit is the source of potash now being produced.

Improvements in Water Distribution System Under Efficient Organization

Chicago Water-Pipe Extension Division Has Engineering Supervision—Engineer of Standards Devises New Appliances and Methods—Some Recent Advances and Savings Described

By R. S. Spalding
Engineer of Water Pipe Extension, Chicago

RECENT improvements in the water distribution system of Chicago include the adoption of a power driven tapping machine and a new fire hydrant, standardization of gate valves, the use of valves of reduced diameter on large mains, and leakage reduction in streets about to be paved.

Distribution of water in Chicago is handled by the water pipe extension division of the bureau of engineering, Department of Public Works. This division has charge of all work in connection with pipe laying and the maintenance of the distribution system from the pumping station walls to the consumers' service boxes. All water main laying work is done by day labor hired by the city, except that mains paid for by special assessment are laid by contract.

Organization: The city is divided into eight districts, each supervised by a district foreman who has charge of all construction and maintenance work in his district, with the exception of the laying of large feeder mains, which is done by a floating construction gang. This gang is equipped with three trench-digging machines and lays not only feeder mains but also small mains where machine work is economical and where there is sufficient work to be done at any one place to warrant the use of a machine.

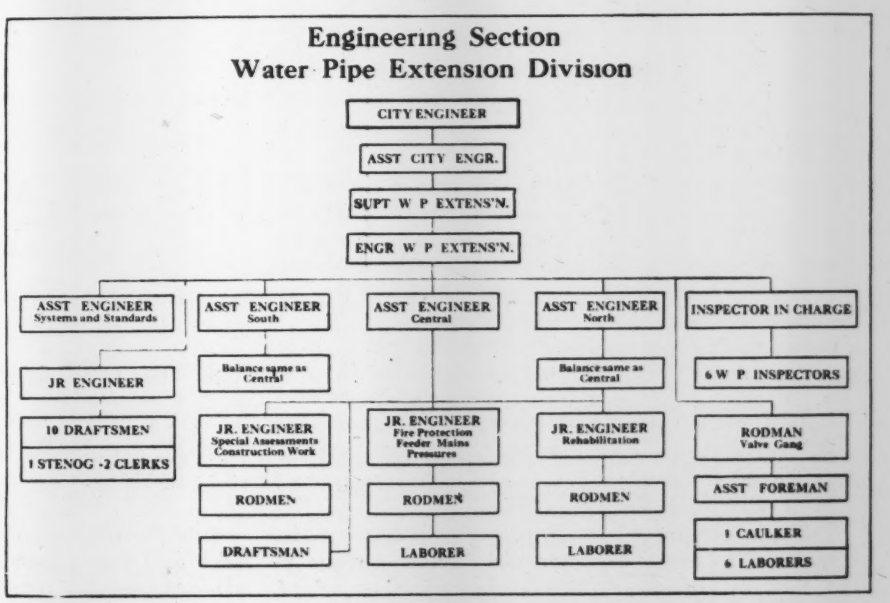
The engineering work of the division is supervised from the main office by the engineer of water pipe extension, who reports directly to the superintendent. Under the engineer of water pipe extension are an assistant engineer of systems and standards and three division engineers, each of whom is in charge of the engineering work in a section of the city comprising about 90 square miles. Frank I. Bennett is commissioner of public works; John E. Ericson is city engineer; H. W. Clausen is assistant city engineer; H. L. Lucas is superintendent of water pipe extension, and R. S. Spalding is engineer of water pipe extension.

The engineer of systems and standards works in the main office, devises new schemes and keeps in touch with everything done by the engineering and other forces, so that the most efficient methods of handling work may be used. He also keeps himself informed concerning practice in other cities so that the most modern methods may be utilized in Chicago.

Power Tapping Machine: Up to a few months ago all service taps larger than 2 in. were made by a hand-power machine. This method required a gang of four to six men. After considerable study it was decided to drive the machine by an air motor supplied from a compressor of 40 cu.ft. capacity mounted on a 1½-ton truck and driven from the truck motor by means of a silent chain and sprocket. This sprocket was mounted on the shaft back of the transmission case and connected through a clutch to the transmission. The new driving equipment was devised by the pipe extension division.

This outfit makes all cuts from 3 to 8 in. in diameter, inclusive, on all sizes of mains from 6 to 48 in. It is operated by a machinist who, with the truck driver, does the work instead of the gang of four to six men formerly necessary. The entire operation of making connection from the main to the service, including the setting of connection on pipe, making of cut and reloading of machine on truck, can be performed in about 45 minutes. The actual cutting time is about 20 minutes. By the old hand method of making cuts the complete operation took from two to four hours.

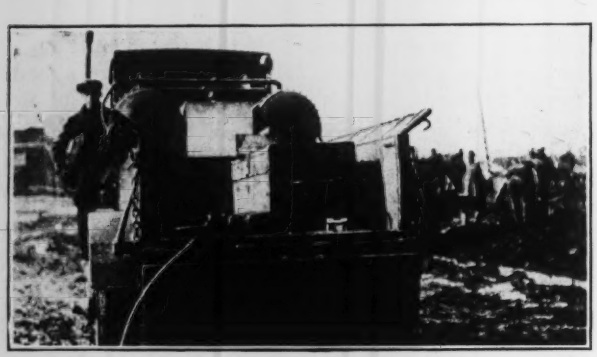
New Fire Hydrant: For years the city of Chicago has made its own fire hydrants. This type of hydrant, called the Cregier, after the inventor, was fairly satis-



ENGINEERING SECTION OF CHICAGO WATER-PIPE EXTENSION DIVISION HAS FIVE SUB-DIVISIONS

factory in operation, except that the automatic drain valve gave considerable trouble. There were also an auxiliary valve in the bottom of the hydrant and independent nozzle valves, all of which resulted in high maintenance costs as well as comparatively high manufacturing cost.

In 1915 an intensive study of various hydrant designs was made and a new type of hydrant was designed. It embodied the best features of the types tested. Our investigation included a test for ascertaining the loss of head in each part of each hydrant under varying dis-



LARGE PIPE TAPPING MACHINE IS DRIVEN BY COMPRESSED AIR FROM MOTOR TRUCK

charges and an examination of details, with a view to obtaining accessibility and easy replacement of parts. As a result, the new Chicago 4½-in. hydrant can be repaired at a much less cost than was possible with the old design. It is so made that the entire valve assembly, including operating stem, can be removed, repaired and replaced without excavation.

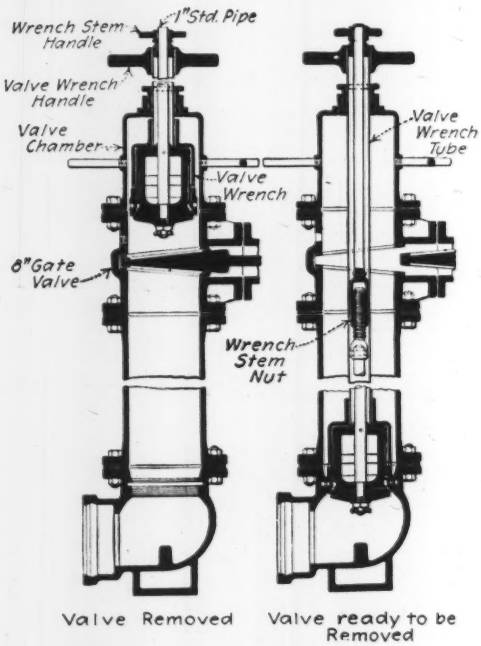
A novel feature in connection with the use of this hydrant was developed on account of the fact that auxiliary gate valves are not installed on the hydrant branch. The novelty consists of a valve wrench for removing the working parts of the hydrant. An 8-in. gate valve is installed in place of the hydrant head, and the valve chamber is placed above this gate valve. The wrench is then operated through a stuffing box at the top of the valve chamber and engages lugs on the hydrant valve seat, removing the valve seat, which, together with the hydrant valve assembly, is pulled up above the gate valve. The gate valve is then closed and the valve chamber above it removed. The necessary repairs may then be made to the hydrant valve assembly, which is replaced in the same manner. This operation is performed very quickly and without the closing of the main to which the hydrant is connected.

Nozzle valves are not used on the new hydrant, as experience has shown that they are expensive to maintain. Instead, each fire company is now equipped with a portable 4½-in. valve which is attached to the unused nozzle when the hose is connected with the hydrant. This makes it possible for a second engine to connect without shutting down the hydrant.

The new hydrant has an 8-in. barrel and two 4½-in. nozzles. The nozzle diameter and thread conform to the National Board of Fire Underwriters' standard. This hydrant is manufactured in the city's shops and all parts are interchangeable.

Gate Valves Design Standardized: As in most large cities, Chicago has in use many different makes of gate valves. This makes it difficult to carry in stock a sufficient number of repair parts. Usually the part which was required for the valve repair was not in stock and was often hard to obtain, making it frequently necessary to remove the valve, although the broken part was of small consequence in itself. This situation has brought about the standardization of gate valves.

A design was made of each size of gate valve from 3 to 36-in., embodying the best practice in the manufacture of valves. The valve as designed is a bronze-mounted, double disk, parallel-seat valve with independent stem nut. All parts are interchangeable. Like the hydrants, these valves are made by the city. An investigation of the advisability of using valves of reduced diameters on large pipe lines showed that while it was true that the use of valves of smaller diameters than the pipe lines resulted in small increased friction loss, nevertheless the saving on the additional cost of installation, as well as the reduced cost and speed of operation and maintenance, showed that this practice was advisable. The use of these valves of reduced diameter also lowered the number of sizes of valves to be



NEW FIRE HYDRANT HAS VALVE ABOVE HYDRANT HEAD INSTEAD OF IN BRANCH

used. The table below shows the practice now adopted by this city:

Size of Pipe, In.	Size of Valve, In.
Up to and including 16	Full size.
20 to 24	16
30 to 36	24
42 to 48	36

It is the intention of the city, also, to furnish the iron body gate valves used on service pipes. Hitherto these valves have been furnished by the plumber laying the service pipe, with the result that cheap valves were used and it was frequently impossible to procure repair parts

because of the fact that very often the maker's name could not be determined.

Rehabilitation of Mains and Services: The rehabilitation of the water mains and service pipes in streets about to be paved has reduced leakage in the distribution system. When it is decided that a street is to be paved, all the service boxes are adjusted to the new street grade and the shut-off cocks are put in operative condition. As soon as this is done the main is shut down and the curb cocks closed. This section is then fed through a 1-in. meter by-passing one of the gate valves controlling the section. By this means it is learned whether or not there is any leakage in the mains or services up to the curb lines. If a leak is indicated, steps are taken to locate it. Aquaphones are used on all services. Test holes are sunk on top of the main by means of an ordinary ship auger, the aquaphone being held on a rod touching the pipe. In these and other ways the engineering party is able to locate leaks. It is sometimes necessary to split a section into two or more parts by cutting and plugging the pipe, in order to aid in determining the location of possible leaks. These investigations and tests are carried on until the main is found to be tight.

During 1917, a total of 108 miles of mains were tested in this manner and leakage amounting to 1,500,000 gal. per day was found and stopped. If this rate were applied to the whole system it would represent only about 6% of the average daily pumpage, indicating that the leakage in mains is not as large an item, compared to the total amount of water wasted, as is commonly supposed.

Cast-Iron Pipe Prices in Boston from 1868 to 1917

WHAT the cast-iron pipe which went into the Boston water-works and the Metropolitan water-works during the long period from 1868 to 1916 actually cost the purchaser in Boston is shown by the accompanying table:

COST OF CAST-IRON WATER-PIPE IN BOSTON FROM 1868 TO 1917.

	20-In. and Larger		10-In. to 20-In.	
Year	Tons Purchased	Price per 2,000-Lb. Ton	Tons Purchased	Price per 2,000-Lb. Ton
1868	2,850	$67.65	1,430	$64.63
1870	1,310	47.50	2,732	47.04
1871	.....	.....	1,726	51.33
1873	.....	.....	1,652	54.48
1874	1,934	46.02	2,846	43.63
1875	336	41.07	3,858	37.50
1876	.....	.....	2,442	31.25
1877	3,808	25.83	605	26.78
1878	538	23.14	1,086	23.03
1880	5,624	36.56	778	37.50
1881	28	28.48	756	28.48
1882	.....	.....	908	34.82
1883	1,188	23.43	750	32.85
1885	3,158	23.62	1,160	25.93
1886	.....	.....	1,198	26.25
1887	2,906	29.84	2,218	28.26
1888	.....	.....	1,568	25.40
1889	1,624	24.51	930	24.60
1890	1,008	27.09	1,848	27.58
1891	1,456	24.95	1,848	24.82
1892	.....	.....	1,204	22.68
1893	1,668	22.51	112	23.16
1894	1,692	20.04	2,016	20.04
1895	12,152	20.65	.....	.....
1896	28,955	19.21	1,395	18.18
1897	22,837	17.56	376	16.82
1898	1,958	17.55	2,548	16.84
1899	1,708	18.76	.....	.....
1901	18,682	24.25	.....	.....
1902	.....	.....	417	25.40
1908	4,251	22.40	.....	.....
1909	9,736	24.37	753	22.98
1910	1,657	24.72	.....	.....
1911	2,429	21.60	60	21.60
1912	107	23.50	20	23.50
1913	403	23.00	.....	.....
1914	9,112	20.00	30	20.90

Year	Tons of Pipe Bought	Weighted Av. Price per 2,000 Lb. Ton	Pounds of Fittings	Av. Price per Lb.	Ratio of Fittings to Pipe p. c. Weight	Cost
1912	3,335	$20.95	340,854	2.28c.	5.1	11.1
1913	8,059	21.20	582,589	2.48	3.6	8.4
1914	3,620	21.10	953,477	2.49	13.1	30.8
1915	4,333	17.05	488,932	2.51	5.6	16.6
1916	2,506	29.15	619,188	2.88	12.2	24.4
1917	2,242	45.18	582,059	3.98	13.0	22.8

Where more than one lot was bought in a year the average cost for the year has been computed. The figures from 1868 to 1894, inclusive, are prices paid by the Boston water-works, and from 1895 to 1914, by the Metropolitan Water and Sewerage Board. The board bought no pipe in 1915, 1916 or 1917. Supplementary figures for the year 1912 to 1917 are given, in somewhat different form, with cost of fittings added, for the Boston water-works.

The figures for 1868 to 1914 were originally compiled by the late Dexter Brackett, and were published in *Engineering News* of Jan. 31, 1915, p. 29, Construction News Section.

Errors were introduced in reprinting the figures through correcting tons of 2240 lb., used up to 1894, to tons of 2000 lb., without making corresponding conversions in the price per ton. These errors have been corrected in the present table by slide-rule computations made in the office of Metcalf & Eddy, consulting engineers, Boston. The Boston prices for the years 1912-17 have been added by Metcalf & Eddy.

Board Is Studying Transportation to Shipyards

Bureau Organized Apr. 1 with A. Merritt Taylor as Head Has Begun Survey of Needs and Means for Supplying Them

TRANSPORTATION to and from the various shipyards in the country is conceded to be closely tied up to the question of housing. On Apr. 1 the Emergency Fleet Corporation organized a passenger transportation service section with A. Merritt Taylor, formerly director of the Department of City Transit, Philadelphia, as manager of passenger transportation. Steps were immediately taken to develop a plan of survey at each shipyard, the survey aiming to disclose the needs of each yard and the means available for supplying those needs. Much progress had already been reported Apr. 26, the conditions having been found satisfactory at many of the yards, and specific remedies having been proposed at others. An account of the activities of the passenger transportation service section during the first month is given in the *Electric Railway Journal.*

Existing Needs

As an aid to the investigation, the War Board of the American Electric Railway Association, within a week of the organization of the passenger transportation service section, sent out a questionnaire to electric railways calling upon them to state what equipment they could release for the Shipping Board's needs. For any particular shipyard the first division of the survey—that relating to the yard's needs—embraces a checking

over of the questionnaire, the preparation of maps and photographs showing the transportation conditions to and from the yard, a rough check of the traffic flow, and the development of a general line of recommendations for such facilities as additional equipment, additional trackage, possible rerouting and special train service. On a sketch map of the shipyard property is indicated the situation of entrance and exit gates to the yards; important streets in the vicinity, with types of pavement and transportation lines thereon; availability of near-by sites for sidings or terminal loops, with supplementary data as to ownership, present use and probable cost; and character of adjacent territory, including availability for resident purposes of all land within walking distance of the plant.

Available Facilities

Under the second division of the survey, that relating to the means available for supplying transportation needs, there is prepared a complete map of the street railway system or systems; an inventory by types and capacities of the cars operated, with the proportion of such cars serving the various districts through which the company operates; data as to the number of cars operated on routes serving the shipyard; data as to the lines serving the shipyard and adjacent districts, with the distances between and lengths of turnouts; data regarding existing power capacities, availability of additional sources of power, and steps necessary to utilize such sources; a report as to the physical condition of tracks and bridges, and the extent and cost of needed repairs; a statement from the company as to steps to be taken to provide adequate and satisfactory service, with estimates of cost; together with numerous other data relating to the details of electric railway operation, consideration of such substitute facilities as water transportation or auto-bus routes, and means of expediting the provision of required additional facilities.

The map shows routes serving the shipyard with and without change of cars; the industrial and commercial districts served; the fare and the time zones; heavy grades, if any; steam railroad crossings and drawbridges, with notations as to delays caused thereby, and the ownership and probable cost of land which may be required for additional facilities. The study of operation goes into the number, types and capacities of cars operated during rush hours and off-peak periods; the headway during rush hours and off-peak periods, and a general study of the platform labor situation in so far as it has a bearing on the service possible.

The investigation of the feasibility of auto-bus routes is comprehensive, going into the character of the road—foundation, surface, width, cross-section, condition, responsibility for maintenance, limiting height of overhead obstructions, and determination of most feasible city streets for routes; the character of the territory, including the character and extent of the vehicular traffic now using the road, and an investigation of sites for garages and shops; and the character of traffic which would use buses.

To expedite the provision of required additional facilities, the bureau, working with the shipbuilding company which is to prepare the plans and specifications and complete schedules of requirements of material and equipment, aims to aid in the execution of necessary local ordinances and permits, to arrange with the Priority Board for the movement of supplies, to close contracts with manufacturers and to follow up shop construction and deliveries. It will also follow up and see that agreed operating improvements are being worked out and put into effect, and will make field observations from time to time to determine the extent to which additional facilities and changes in operation have abated deficiencies in transportation.

In accordance with the procedure outlined, engineers of the passenger transportation service section have already surveyed the needs at the larger Eastern yards, such as those at Chester, Newark Bay and Baltimore. The shipyards at Beaumont, Savannah, Houston, Brunswick, Jacksonville, Everett and Bellingham have reported satisfactory conditions, as have at least part of the builders at Mobile, Wass Point, Madisonville, Orange and Pascagoula. Conditions on the Pacific coast are reported satisfactory, except that more electric service could be used at Seattle.

As an indication of what the bureau is able to accomplish in specific cases, the Newport News & Hampton Electric Ry. is building a 3- or 4-mile extension north of Newport News to a new housing development. The Shipping Board has advanced the money for the line and for the purchase of ten cars. At Oakland the key route is to be extended one-half mile to the Moore shipbuilding plant. At this location also service has been improved by the closing of the drawbridge between Alameda and Oakland.

Ships may be used, as at New London, where a ferry has been installed for service to the Bath Iron Works. To date, however, it has not been found necessary to use motor trucks or buses.

Milwaukee Grades Civil Service Positions

Civil service procedure in the city and county of Milwaukee is now on substantially the same basis. On Feb. 18 an amendment to the civil service act fixing uniform and standardized ranges of salaries was adopted by the Wisconsin legislature. The city adopted a similar schedule of services and grade Nov. 5, 1917. Both were put into effect following reports by J. L. Jacobs, consulting engineer, Chicago.

The salary ranges for the grades in county and city are shown in the accompanying table:

Grade	Title in County	Title in City	Salary
I	Draftsmand and rodman	Draftsman and rodman	$ 55 to $ 75
II	Map draftsman	Engineering draftsman	80 to 105
	Junior engineer	Junior engineer	80 to 105
		Junior layout engineer	80 to 105
		Map engineering draftsman	80 to 105
III	Assistant civil engineer	Assistant arch. designer	120 to 140
		Ass't civil engineer	120 to 140
		Ass't structural engineer	120 to 140
		Chief engineering estimator	120 to 140
IV	Eng. chg. road cons.	Draftsman (Park Commission)	160 to 190
		Arch. and str. designer	160 to 180
		Senior engineer	160 to 180
		Chief draftsman (Sew. Com.)	170 to 190
		Senior engineer (Sew. Com.)	170 to 190
V	Highway commissioner	Designing eng. (Sew. Com.)	250 and up
		Prin. ass't eng. (Sew. Com.)	300 and up
		City planning engineer	200 to 250
		Eng. chg. cons. and mn. (Illumination)	200 to 250
		Eng. chg. of illumination	200 to 250

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

When Shear Controls Load Distribution on a Concrete Slab

Sir—In the analysis of the distribution of a concentrated load on a reinforced-concrete slab there are several independent tests and some theoretical conclusions which are in close agreement as concerns the effective width for moment, particularly when the load is at the center of the span and the width of the slab is about twice the span or greater. These are very good as far as they go, but unfortunately in many cases of slab design the shear rather than the moment controls the depth, and it is apparent that our theory of distribution will not apply.

For instance, the maximum shear is given when the concentration is just at the edge of the slab support. In this case, according to W. A. Slater's formula, there would be no distribution, and the total shear would have to be considered as carried by a single element of the slab. Suppose we arbitrarily assign a width of one foot to this element, which is more than the theory indicates. It is obvious that this would be too small, since it is entirely evident that a slab will bear a greater concentration at a support than would a beam one foot wide and of the same depth.

Supposing that there is no distribution in the previously accepted sense, it is apparent that there are three shearing planes for any element which we may assume to carry the full concentration, and it is equally apparent that the equivalent width for distribution of shear is a very appreciable quantity. It is plain that this width is not a function of the span; the writer can not see how it could well be other than a function of the slab thickness and unit stress.

The writer has no theories to offer in this connection, but it occurs to him that this is a fertile field for investigation.

S. M. COTTEN,
Arizona State Engineering Department.
Phœnix.

Why Pavements Are Crowned

Sir—The question "Why are pavements crowned?" has been raised in a law suit in which the writer was a witness, and it brought the question home to me. It is imperative that pavements be properly crowned, and so I write to start a discussion among highway engineers.

Perhaps we all agree that the chief reason for crowning a pavement is for drainage purposes; then, too, the crown adds to the appearance of a roadway. Yet this fact remains, that the crown concentrates the traffic on the roadway and causes the pavements to rut.

The case referred to above concerned a bituminous macadam pavement, a waterproof construction. The roadway was 40 ft. between curbs and was built so that the middle of the roadway was 6 in. above the gutters, the cross-section of the roadway being of parabolic form.

My opinion was that 6 in. is sufficient, though I believe the slope should have been uniform from gutter to crown. The reasons for using a parabolic curve for roadway surfaces are evidently, first, for appearance, and second, to provide a larger capacity for the gutters. I can see no other reasons. The part of the road that receives the greatest amount of wear gets the least drainage, with the parabolic curve. Hence, I prefer a uniform slope.

Excessive crowns, as before, stated, tend to concentrate the traffic and make smooth pavements slippery, and in the case of sand-filled block pavements on sand cushions cause the sand to be carried by water flowing toward the gutters under the pavements.

Why not make crowns of a sensible height? I know of streets 30 ft. between curbs that have a crown of 24 in. Perfectly ridiculous construction, to say the least. The result was that there are now two summits instead of one, because of the large rut worn in the center of the pavement.

I should like to hear what others think of this.

JOHN G. SCHMIDT,
The Robinson Clay Product Company.
Akron, Ohio.

Against Median in Rainfall Statistics

Sir—In *Engineering News-Record* of Mar. 28, p. 628, there appeared a letter by Dana M. Wood advocating the use of the median rather than the arithmetic mean in rainfall statistics.

If Jupiter Pluvius issues rain to Massachusetts according to the Gauss law of distribution, there is but one side to the proposed argument; namely, the negative. For such conditions there is a mathematical proof that the arithmetic mean is a more probable value than the median. To assume that the median is a more probable value than the arithmetic mean is a tacit assumption that the Gauss law does not hold. This being the case, either is likely to be the more probable value depending upon conditions inherent in the statistics themselves, and the selection of either one, or neither, is not a matter of *a priori* conjecture. In the particular case of rainfall the peculiarities of the climate under consideration are certainly important determining factors.

From a practical viewpoint, both the median and the arithmetic mean are equally inadequate for the purpose they are usually intended to serve; namely, as a characteristic of data which present them in condensed form. A somewhat trite example will explain my point: An impression of affluence is given by a statement that the average wealth of a community is $200,001, and an impression of general penury is given by the statement that the median wealth of a community is $1. Both of these impressions, neither of which is true, may be obtained from the respective statements regarding a community of five individuals in which one possesses $1,000,001, and the other four possess $1. This example shows the inadequacy of a single characteristic and makes evident the necessity of at least a second which indicates the variation or "dispersion" of the data.

Under the Gauss law of distribution the "probable error" and the "average deviation from the mean" are often used to indicate dispersion. Their application to other types of distributions should be attended with caution and with due regard to the nature of the statistics themselves.

There is no true mathematical support for any particular function as the *most probable value a priori* under the Gauss probability law. The use of the arithmetic mean in that role is traditionary and carries the preponderance of precedent use by the illustrious founders of the theory. It affords a continuous link between the probability theory and the method of least squares, and, inasmuch as the latter is the more common and practical application of the major subject, arguments for its continuance in that role are well founded in their obtuseness.

The application of the probability theory to certain phases of engineering work is receiving impetus. Mr. Woods' proposal is inopportune because speculations of this sort tend to add confusion to the intricacies and thus deter appreciation of a set of intensely practical and potent principles affecting all phases of human activity and interest. The attitude of the novice or casual acquaintance with the theory should not be subjected to prejudice by assailing it with contradictory conjectures based on a superficial investigation of a subject of vastly profound logical foundation.

HARRY M. ROESER.

Bureau of Standards, Washington, D. C.

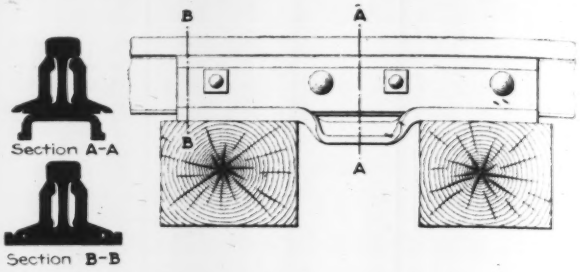
Rail Joints Improved By Base Supports

Sir—An article in *Engineering News-Record* of Mar. 7, page 449, relative to a railway accident, quotes from the report of the Interstate Commerce Commission which places the blame on the rail joint. Several years' experience in construction and maintaining track on trunk lines and "jerkwater" roads brought to my attention the weakness of joint fastenings and led to a desire to overcome this weakness. As a result of study and experiment the base-supported joint shown in the drawing was designed and was patented in 1912. Some of the joints were placed in the yards of the Atlanta, Birmingham & Atlantic Ry., in December, 1912. A favorable opinion was given; no criticism has been made, nor has any weakness developed.

The baseplate of channel section is intended as a strengthening support for an angle-bar joint. The portions resting on the ties are equivalent to tie-plates. The ribs prevent side motion of the splice bars, and the seats on which they rest prevent them from dropping. This construction also eliminates thrust on the bolts. The trussing due to bending the sides of the plate outward and downward at the middle gives elasticity at the ties and a maximum strength at the center, where the rails meet and the wheel blows are delivered. Stiffness is avoided, but sufficient strength is given to the joint to care for all loads coming upon it.

Lexington, Ky. F. S. PARRIGIN.

[The joint illustrated is one of many rail joints of the bridge type, in which the rail ends are supported on a base plate carried by the joint ties. This type of joint has been made the subject of numerous designs and patents.



BASE PLATE REINFORCES THIS RAIL JOINT

In some cases the plate is independent of the splice bars, as in the design illustrated, in the Abbott joint and in the Carter joint used on the Chicago & North Western Ry. The first two of these are much alike and have the plates reinforced by bending them to form deep webs at the middle, while the third design mentioned has no such reinforcement. In other cases, the base plate is formed integrally with the splice bars, as in the Weber, Continuous and other joints. Joints of the base-support type are used extensively on both light and substantial track, and are considered to have particular advantages for light track carrying relatively heavy loads.—*Editor.*]

Are Spirally Wound Concrete Piles Safe in Sea Water?

Sir—Chenoweth reinforced-concrete piles made by the rolling method have been subjected to the action of sea water and the elements for ten years. R. J. Wig and L. R. Ferguson of the Bureau of Standards have conducted careful investigation of the action of sea water on concrete and have collected important facts. The result of this work shows that the premolded concrete piles of the cast-in-a-form type are affected by the sea water and the elements, cracking along vertical lines of reinforcing members that are imbedded therein. So numerous are these cracks in cast piles that they cause serious apprehension.

Reinforced-concrete piles which were made by being rolled around wire mesh reinforcement were examined by Messrs. Wig and Ferguson as late as the fall of 1916. They have reported by letter that no cracks or defects have been found by them, or any indications of weakness in the structure.

The report before mentioned, abstracted under the title of "What is the Trouble with Concrete in Sea-Water?" and published by *Engineering News-Record* in September and October, 1917, is not complete in that it leaves those who are interested in the subject to infer that the Chenoweth pile may be included. This is not the case and should be properly stated in order to prevent any wrong impression.

Why sea water does not penetrate below the outer surface of a Chenoweth concrete pile may be more fully explained later. ALEXANDER CRAWFORD CHENOWETH.

New York City.

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Concrete Freighter "Faith" Passes First Trial

Makes Successful Trip in San Francisco Bay—Handles Easily and Has Little Vibration

Cruising in San Francisco Bay on May 5, the big concrete freighter "Faith" responded successfully to all the tests possible in smooth water. In this trial trip the new 4500-ton ship averaged more than the specified 10 knots speed, although under only 140 lb. steam. Full steam pressure from the Scotch marine boilers and triple expansion 1750 hp. engines will be 165 lb. Extensometer readings on deck and frames made by the United States Shipping Board's representatives, headed by Prof. F. R. McMillan, of the University of Minnesota, showed the vibration to be less, measured in the same way, than on similar steel vessels. The navigator reported that the "Faith" was handled more easily than a steel or wooden vessel of the same size and lines.

As soon as a cargo of salt can be loaded the vessel will be sent to Vancouver under her own steam. On this voyage her behavior will continue to be studied by the government experts aboard.

Waterways to be Discussed

The Mississippi Valley Waterways Assn. will hold its first annual convention at the Statler Hotel, St. Louis, May 14—15. With the passage of the law authorizing the equipment and operation of inland navigation lines, and the action of the U. S. Government in building barges and towboats for the upper Mississippi, it is expected that something can be done to develop materially the coördination of river and rail transportation. Sydney J. Roy, Hannibal, Mo., is secretary of the association.

Minimum Meter Charge Increased

New rates for metered water at Dayton, Ohio, increase the minimum charge by 50%, or from $4.40 to $6.60 a year for a ⅝-in. service, but offer a 5% discount for prompt payment, and abolish the former meter rental of $2 a year. A notice sent to consumers states that the "rates have been fixed after a careful calculation of the requirements to cover expenses, sinking fund charges, and a proper return to the city upon its capital invested in the water-works." The notes per 100 cu. ft. are: Between 1000 and 10,000 cu. ft. per quarter, 9c.; 10,000 to 20,000, 7½; 20,000 to 100,000, 6; 100,000 to 500,000, 5; over 500,000, 4½c. H. P. Martin is director of public service and J. E. Barlow is city manager of Dayton.

Collier Built in Twenty-Seven Days at Yard of New York Shipbuilding Corporation

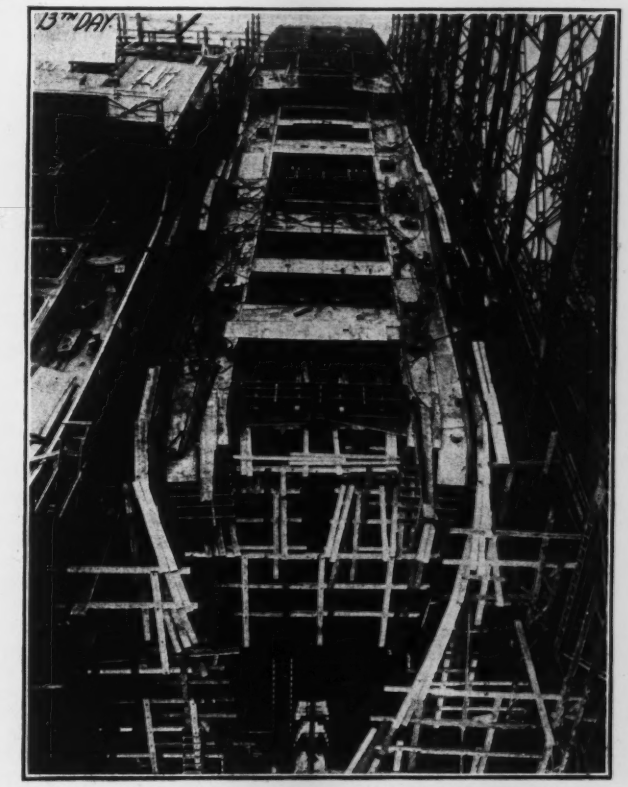
Launching of 5500-Ton Steel Steamship "Tuckahoe" Breaks All Speed Records in Ship Construction

On May 5 the Camden yard of the New York Shipbuilding Corporation launched the steel collier "Tuckahoe," a ship of 5500-tons dead weight carrying capacity. The vessel's keel was laid Apr. 8, so that the complete time of building up to the date of launching was 27 days. The performance is considered the more remarkable because engines and boilers were put in place while the ship was still on the ways.

It is expected that in 10 or 12 days the vessel will be equipped complete and turned over to the Government.

The "Tuckahoe" is 319 ft. long on water line, 332½ ft. long overall, 49 ft. 3 in. in beam and 27 ft. 6 in. in molded depth, equipped with a single screw, and has four holds of a total capacity of 230,000 cu.ft. About 1800 tons of steel are in the structure. The vessel is driven by triple-expansion engines, at a maximum speed of 10½ knots.

The New York Shipbuilding yard is not one of the new emergency shipyards building fabricated steel vessels, but has been in operation for more than 20 years. Officials of the company say that no essential departure from usual methods was involved in the construction of the "Tuckahoe," apart from the fact that three shifts were worked during some parts of the 27-day period. In the latter part of the time only two shifts were maintained and toward the end a single 10-hour shift.



STEAMSHIP TUCKAHOE ON THE WAYS, THIRTEENTH DAY

All the material of the ship had been put through the shop and was in storage at the head of the ways when the keel was laid. The construction of the ship therefore was an example of high-speed erection, in which the shop was not directly concerned.

The company says that no records were made in doing individual parts of the work, as in riveting, but the speeding up was general, and was due to co-

ordination and to sustained effort on the part of the men. No premium-payment methods were used for stimulating labor. The result accomplished is attributed to a general determination on the part of the hull superintendent, Thomas Mason, and his working forces, to drive the job as fast as possible.

City Manager Cummin Resigns

The cause of the resignation, on May 1, of Gaylord C. Cummin as city manager of Grand Rapids, Mich., one of the two cities of more than 100,000 population under the commission-manager plan, is outlined in the following statement sent by Mr. Cummin to *Engineering News-Record*:

"In dealing with budget estimates the commission, after raising a number of salaries, proposed to do away with the separate purchasing department that saved the city over $35,000 in the past eight months, placing the duties on part time of a minor official in another department on the plea of economy. I refused to consent to any such proceeding, not only because it was against every principle of efficiency management to attempt to have these duties performed by a part-time man, but also because it was a direct infringement upon the authority of the manager and was made with the direct object of crippling the manager so that results could not be obtained. I informed the commission if they insisted on this action I would resign, as I could not agree to anything that I knew was wrong and in defiance of my authority, and keep my self respect; that as long as I was responsible for the administration affairs of the city I would have control over my subordinates or else refuse to be responsible. The commission persisted and I resigned. Three out of seven commissioners, all the newspapers and all civic bodies stand behind me in my course and there is no doubt in the public mind as to the motive behind the move of the majority."

Mr. Cummin was appointed city manager of Grand Rapids, May 1, 1917, at a salary of $10,000 a year, leaving for the purpose a similar position at Jackson, Mich., which paid him $6000.

Six Engineers Receive Honorary Degrees from Rensselaer

Honorary degrees were conferred on six prominent engineers at the 94th annual commencement of the Rensselaer Polytechnic Institute. The degree of doctor of engineering was given to Lieut. Col. Henry W. Hodge, U. S. engineer, manager of roads, American Expeditionary Force in France; Alexander C. Humphreys, president of the Stevens Institute of Technology; Edwin W. Rice, Jr., president of the General Electric Co.; William Hubert Burr, professor emeritus of Columbia University, and Onward Bates of Chicago. The degree of master of civil engineering was conferred on Francis E. House, president of the Duluth & Iron Range Railroad.

City Problems Discussed by Minneapolis Engineers

Street traffic as an engineering problem, an allegation that engineers do not fulfil their duties as citizens, and the appointment of committees on street traffic studies and on municipal bond issues, the latter to work jointly with the Minnesota Joint Engineering Board and the Ninth District Federal Reserve Bank Board, were features of the dinner meeting of the Minneapolis Engineers' Club, Apr. 30.

The speaker of the evening was Prof. F. H. Bass, University of Minnesota, who said that although the many ramifications of street traffic lie within the province of the engineer, yet his services are not used as they might be by the community nor is he given the credit due him for things accomplished. Streets are widened to relieve congestion without knowing where the traffic comes from, what it consists of, where it is going or why it uses that street. It may be possible that a congested district requires the rerouting of street cars, jitneys and commercial trucks, but who knows? No one, because the problem has not been fully studied. Arterial streets connecting the business center with country communities are required, but their location is guessed at, not determined by intelligent study. The streets and pavements serve both passenger and industrial traffic. Pavements are worn out by vehicles. A wheel tax is a necessity, and if sufficient would reduce the number of unnecessary commercial trucks. Pavements should be selected for their use, not by the whims of property owners. A consolidated retail delivery system is feasible and would prolong the life of the street surface now worn out prematurely. Many of these problems are thought of separately. What Minneapolis needs is an authoritative agency with the energy and ability to study and put through a plan which will coordinate all interests and result in conserving man power and material.

The president of the Retail Grocers' Association spoke on "Consolidated Deliveries"; the chairman of the pavement committee of the civic and commerce association, on selecting types of pavements; the state deputy highway commissioner spoke of arterial routes.

Mr. Meyer, who, it was reported, had just had the candidacy for mayor offered to him by a citizens' committee opposed to the present Socialistic regime, told the engineers that their weakness lay in their lack of coöperation with citizens and civic bodies and that when they paid their debt of service to the community, acting as citizens instead of posing as experts, they would receive the recognition to which they are entitled.

Tentative Imperial Valley-Laguna Dam Contract Drawn

The proposed connection between the canal system of the Imperial Irrigation District and the Laguna Dam of the Yuma project has reached a stage where a tentative contract between the Department of the Interior and the Imperial Irrigation District has been drawn up. A résumé of this contract made by the Imperial Valley representative of *Engineering News-Record* enumerates the following provisions: (1) The district shall bear expense of all surveys and plans for necessary structures and canals (2) upon approval by the Secretary of the Interior the district shall build such structures and canals, taking full risk for all damages resulting (3) all construction work shall be subject to supervision and inspection by the United States at the expense of the district (4) for the right to use the Laguna Dam the district shall pay the United States $1,600,000 within 20 years, under an increasing schedule of payments (5) the district shall pay its proportionate share of operating expenses of the Laguna system, such expenses to be met quarterly, and, in addition, any extraordinary expenses that may be required to sluice the system due to the increased amount of water handled shall be met entirely by the district (6) all electric power possibilities are reserved to the United States (7) the natural flow of the Colorado River shall be under the control of the United States, and sufficient water up to one-quarter of the flow shall be diverted for use of the Yuma project (8) the contract if signed must be ratified by vote of the Imperial Irrigation District within six months thereafter (9) work must be commenced on the new work within two years.

The feeling in the Imperial Valley is that the terms of the contract are so much in favor of the Reclamation Service and the Yuma Project that the contract in the present form is not likely to be accepted.

Chamber of Commerce for Greater Use of Highways

The Chamber of Commerce of the United States has recently adopted a resolution urging that steps be taken through Government agencies to bring about a greater use of national highways, including waterways, in order to relieve railroad congestion. The resolution has been indorsed by the executive committee of the American Association of State Highway Officials. The resolution is as follows:

"Whereas, it is apparent that the present traffic burden is beyond the capacity of the railroads and that vigorous and successful prosecution of the war is hampered thereby; that it is therefore imperative that our great rivers, canals, and intercoastal water routes, as well our main highways, should be forthwith used to move freight;

"Therefore, be it resolved, by the Chamber of Commerce of the United

States that the Government, through the President and the Director-General of Railroads, be petitioned to organize and operate existing equipment and construct new equipment for use upon the inland and coastwise waterways in accordance with the authority recently conferred by Congress in the transportation bill; to complete trunk highways for heavy traffic where they can be used in relieving railroad congestion; to adopt a permanent policy assuring coördination of railroads, water routes and highways for traffic service."

Would Repair Roads Harmed By Government Trucks

Bill Introduced in House Authorizes Federal Aid to States Whose Highways Are Wrecked

Representative Cooper of Ohio has introduced in the House of Representatives a bill to extend Federal aid to the states for the purpose of repairing and maintaining roads subjected to extraordinary traffic wear by the use of such roads by or on behalf of the Government of the United States during the continuance of the war. The bill, which carries with it an appropriation of $10,000,000, authorizes the Secretary of Agriculture to make investigations into the conditions of such roads, and to consider the maintenance, repair or reconstruction work required, or to grant separate financial aid to the states to put the roads in their original state.

The procedure specified requires the State authorities to make application for aid whenever they consider that "any hard surface road has been, or is being, subjected to extraordinary wear or destruction by reason of Government traffic." The Secretary of Agriculture, having satisfied himself that substantial injury has been done, shall then extend the aid, "such aid to be in the form of money, labor, material, equipment, supervision, or any or all of these." The Secretary is also authorized to obtain information as to ways and means of most effectively reducing or limiting such damage. The proposed act includes bridges and culverts in the meaning of the word "road."

Government Wants 200 Bridgemen for Foreign Service

Two hundred skilled bridgemen are wanted immediately by the Government to form a unit for the construction of several high steel towers abroad. Applicants are requested to communicate with naval enrolling officers of the eastern and central divisions. Residents of New York City should get in touch with G. A. Baldwin, civil engineer, 280 Broadway. Mr. Baldwin will accompany the expedition to Europe.

The opportunity to enroll in this unit is open both to men within and without the draft age. Applicants accepted will be enrolled in the United States Naval Reserve under advanced rating for skilled workers.

All Ports and Terminals To Be Co-ordinated

Federal Commission Appointed With Representatives from Different Government Branches

Control of all the ports of the United States and the more economic and rapid distribution of overseas freight to waiting vessels is purposed by the recent appointment by the United States Shipping Board of a commission on port, terminal and harbor improvement. Edward F. Carry, at present director of operations of the Shipping Board, has been appointed head of the commission. The appointment of the body is one of the results of the transportation and shipping congestion of last winter, when port facilities were so impeded as to cause reaction on the approaching railways, with consequent delay in sending freight and men overseas. The railroad administration and the Shipping Board have been coöperating to stabilize shipping conditions, utilize all port facilities in the most economic manner, and correlate rail transportation with overseas traffic, and the new commission will continue this work on a larger scale.

Since the Shipping Board, the army, the navy and the railroad administration are all interested in this coördination, each has a representative on the commission. The army's interest is to see to it that embarkation ports are so arranged that there will be adequate railroad, warehouse and other facilities. The commission will deal with bunkerage facilities, which are of interest to the navy. The railroad administration is working to avoid wasteful journeys of freight. The private shipping interests have also a representative on the board.

The commission's work will include not only the study of the port and railroad facilities of the country, to present at any time the data on which assignment of cargo can be made, but it also will investigate and recommend improvements in port facilities. The State of New York recently appropriated $200,000, to be spent in connection with the New York and New Jersey Port Commission in the investigation of the harbor conditions of New York City. This interstate commission will coöperate with the Federal commission in the study of New York harbor.

Members of the board, in addition to Mr. Carry, are Benjamin E. Winchell, Samuel M. Felton, Capt. A. C. Hodgson, U. S. N., George F. Dearborn, J. H. Rossiter, and Dean E. F. Gay of the Shipping Board.

Another Examination for Commissions in Engineer Corps

Young engineers of proper qualifications will have opportunity to get commissions in the corps of engineers, regular army, by taking an examination to be held at army posts throughout the country July 8-12.

The examinations will be open to male citizens of the United States, unmarried, at least 21 years old and less than 29, and who hold diplomas showing graduation in engineering courses from approved technical schools. Candidates otherwise eligible who are serving in the army in any branch of the service as commissioned officers or as enlisted men may take the examination.

Special attention is called to the fact that a former prerequisite for eligibility to take this examination, that of eligibility for appointment as junior engineer under the engineer bureau of the War Department, has been waived by the Secretary of War under authority contained in the National Defense Act approved June 3, 1916, so that candidates for commissions as provisional lieutenants in the corps of engineers are now required to take only the one examination.

The office of the Chief of Engineers, Washington, D. C., will be glad to furnish additional information, including an application blank and sample questions used in a previous examination. Such applications must be returned to Washington by June 15.

Engineer and Contractor Put on War Finance Corporation

Clifford M. Leonard, president and treasurer of the Leonard Construction Co., Chicago, and the Canadian Leonard Construction Co., Ltd., has been nominated by the President to be a director of the War Finance Corporation for a term of two years. Mr. Leonard is a graduate of the Massachusetts Intitute of Technology, class of 1900, and before forming the contracting companies with which he is connected had been engaged in railway engineering work and in structural designing.

New Record Keel Laying Made on the Pacific Coast

At the Portland, Ore., yard of the shipbuilding department of the Foundation Co., New York, the keel of a 3000-ton ship was laid recently in 1 min., 45 sec., or one-sixth of the record time made after the launching of the U. S. S. "Accoma" at the Passaic River yards of the same company. This feat was made possible by careful drilling of a force of over 100 men, at each of the previous launchings. At first the work could not completed in less than 20 minutes, but as the men became more experienced this time was cut to 16 minutes, 6½ minutes, and finally to the record time of 105 seconds.

Improved Garbage and Refuse Plan for Cincinnati

Municipal collection and disposal of garbage, dead animals, rubbish and ashes, each to be collected separately, are recommended in a detailed report by William C. Folsom, sanitary engineer, department of health, Cincinnati, to Dr. J. H. Landis, health officer. The investigation and report were authorized by the city council early this year. For disposal of garbage, offal and dead animals a Cobwell reduction plant is

advised. A rubbish sorting and utilization plant is recommended, the tailings to be burned in an incinerator equipped with water-tube boilers which would produce steam for works purposes at the incinerator and reduction plant. For the collection of garbage and offal horse-drawn equipment is advised, with light-motor trucks for sparsely settled rural districts. The garbage would be transferred to motor trucks at three district stations, storage to be afforded in detachable truck bodies until the garbage was hauled to the reduction works at Liberty St. and the Baltimore & Ohio Railroad.

The collection and the haulage of rubbish would follow the same general plan as that for garbage, but the rubbish would be hauled to the city's incinerator in the collection wagons serving as trailers to motor trucks. Large dead animals and animal offal would be collected and hauled by motor equipment. Ashes would be collected in wagons and used to reclaim land which should be owned by the city in order to secure its increased value.

Case School Offers Mechanical Drafting Course to Women

For the first time in its history, the Case School of Applied Science, at Cleveland, will be open in June to women students. The school for women will consist of a three months' course this summer in mechanical drawing and drafting. It will be open to all girls and women who have been through high school, although the enrollment of college women is especially desired. If students desire they may take only six weeks of the course this summer and return next summer for the final half.

Women who complete the Case course will be given certificates which will qualify them for Government service in mechanical drafting in the War Department, the Navy Department and the Bureau of Ordnance. Positions in copying and topographic drafting will be open in the Geological Survey service.

The only requisites for entrance to the college are a fair knowledge of arithmetic, algebra and geometry.

Last Captured American Engineer Released by Chinese Bandits

George A. Kyle, Portland, Ore., engineer for the Siems-Carey Railway and Canal Co., who has been held captive by Chinese bandits since Mar. 5, as reported in *Engineering News-Record* of April 4, p. 684, has been released and is now back in Peking.

Mr. Kyle's release was effected by Charles D. Tenney, Chinese secretary of the American legation, and F. C. Hitchcock of the Siems-Carey Railway & Canal Co., in conjunction with the Chinese General Chang and the Catholic Mission.

E. J. Purcell and George A. Kyle were captured together on Mar. 5. Purcell was recently released.

Heavy Exports of Construction Equipment in 1917

Department of Commerce Report Shows Increase in Machinery Sales Abroad

Some interesting figures on the export of American engineering and construction machinery are revealed in the latest report of the Department of Commerce, covering the year 1917.

When it is considered that the figures for some equipment are not complete for the 12 months, having been compiled as separate items only for the period from July 1 to the end of the year, the volume of this business looms impressively. While the greater part of this equipment was shipped to the countries allied with America in the war, still there have been substantial shipments to South America, the British colonies and other places outside the war zone. In some cases comparative figures are available for the past three years, but in many cases the department has only kept record of the exports of certain equipment during the year 1917, the exports previously being grouped under the head of "all other manufactures of iron and steel."

The increase in exports of steam locomotives from $9,779,715 in 1915 to more than $30,000,000 in 1917 is particularly striking. Nearly $6,000,000 worth was shipped to Russia in Europe. France received more than $7,000,000 worth.

Minnesota Plans to Settle Labor Disputes Without Federal Aid

Minnesota plans to settle its labor troubles without appealing to the National War Labor Board for assistance. Labor and capital in the state have formally agreed to have no strikes or lockouts during the war "under any circumstances."

Following the ratification of an agreement by organizations officially representing both sides, Governor Burnquist has appointed a State Board of Arbitration and Conciliation, consisting of Robert S. Pack, vice-president and general manager, Northern States Power Co., Minneapolis, and Raymond S. Schroeder, attorney with union labor affiliations, St. Paul. The voluntary agreement to submit all disputes to this board has been incorporated in an official order of the Minnesota Council of Safety. Several controversies have already been settled without loss of work, time or production.

The agreement reached between employers and employees contains the following principal features: continuous and uninterrupted production; that employees shall not seek recognition of a union which had not been organized before the war; that employers shall not, by a lockout or by other means, attempt to break up a union which had been organized before the war; that employers and employees agree to maintain the existing status in every place of employment, of a union, nonunion or open shop; that employers and employees agree that difference with respect to wages or hours of labor shall be referred to the State Board of Arbitration for adjudication under the provision of the laws of the state; that during the period of the war there shall be neither strikes nor lockouts under any circumstances and that pending any decision by the arbitration board work shall be continued uninterrupted by either party.

Prospect of Much Larger Army a Stimulus to Builders

Announcement that the Government intends to add large additional forces to the army has acted as a stimulus to construction interests, including manufacturers, distributors and carriers of building materials, as well as contractors.

The important factors in building industries consider that if the present war footing has absorbed all available space for storage, manufacturing, executive or administrative purposes, much larger forces to be supplied with food, clothing, shelter, ammunition and other necessaries will cause a still greater demand upon the present inadequate building facilities and will practically compel additional construction work to meet the emergency. This does not contemplate the heavier pressure on building and housing facilities which will be caused by the extra man power required for ammunition factories and warehouses to maintain an added military force.

It is reported that building material industries have anticipated this situation and have taken measures to have on hand large amounts of reserve material.

Civil Service Examinations

New York State—Among the examinations announced by the Civil Service Commission of the State of New York, scheduled for May 25, appear the following, for which application must be made before May 15. Application forms may be procured from the State Civil Service Commission, Albany, N. Y.

ENGINEERING INSPECTOR, State Architect's office. Salary from $1800 to $2200 and necessary traveling expenses. Position requires technical knowledge of steam and hot-water heating systems, plumbing, electric wiring, house sewage disposal, refrigerators, steam power equipment, materials of construction and testing, testing of instruments, machinery foundations, architectural plans and specifications. It is also desired that applicants have practical experience in supervising the installation of machinery and that they be familiar with various makes of machinery and apparatus used for the foregoing purposes, together with a general knowledge of Underwriters' rules. Graduation or a partial course in mechanical or electrical engineering is desirable.

LAND SURVEYOR. Conservation Com-

mission. Salary $3000. Preferred age over 35 years. Candidates should have not less than 10 years' experience in actual work in charge of surveying and relocating old lines in Adirondack region. Duties of position require thorough knowledge of and experience in surveying old lines, with ability to determine proper lines and relocate them.

Ohio River Contractors Petition Government to Postpone Work

Contractors working on Government locks and dams on the Ohio River have petitioned Congress to hold up the work until after the war, alleging that the increased cost of labor and materials would cause the contractors enormous loss, and probably drive some of them to the wall, as the contracts were accepted during peace times when conditions were normal. The delegates who presented the petition in Washington included P. E. Hunter, president, Independent Construction Co., Pittsburgh; John R. McArthur, McArthur Brothers, New York, and Mr. Rogers, of the Bates & Rogers Co., all of whom are handling Ohio river work.

Objection to holding up the work has been made in the belief that contractors on other Government work might take the same attitude. Col. Henry Newcomer, of the army engineers, has expressed the belief that the contractors are entitled to relief, as they have been pinched hard by rising costs.

Record Bituminous Output Reported by Fuel Administration

The Fuel Administration has announced a new record for the production of bituminous coal for the week which ended Apr. 27. It is represented by an output of 11,668,000 net tons. The average production per working day was 1,946,000 net tons, as compared with 1,840,000 net tons for the week which ended Apr. 20 and 1,680,000 net tons in April, 1917.

Appeals to increase production are being constantly issued by the fuel administration to keep the mines running as near capacity as possible during the summer months. Consumers have been repeatedly requested to place their orders for coal as early as possible, in order that the orders might be distributed over the period before cold weather; to avoid the possibility of production falling off because of lack of orders. It is reported that consumers have responded well in the East, but that some of the Western mines have been set back somewhat by lack of orders.

"La Technique Moderne" of Paris Resumes Publication

La Technique Moderne, Paris, which ceased publication after the issue of Aug. 1, 1914, because its managers, editors and a majority of contributors were mobilized, has resumed publication after being suspended for 3½ years.

Second Federal Housing Bill Passes Congress

To Spend $60,000,000 for Homes For War Workers, Washington Getting One-Sixth of Amount

Both houses of Congress have passed the so-called Department of Labor housing bill and have agreed in conference to various amendments to the original bill. Only the President's signature, which will undoubtedly be forthcoming, is needed to make the bill a law. The new act appropriates $60,000,000 to provide "housing, local transportation, and other community facilities for such industrial workers as are engaged in industries connected with and essential to the national defense . . . during the existing war." Of this amount $10,000,000 is to be spent in the District of Columbia to take care of the employees of the government there.

As originally written, the bill vested all power of administration of the fund in the Secretary of Labor, which distinguished the appropriation from the one for $50,000,000 made some months ago to house ship builders. The administration of the latter fund was vested in the Shipping Board. An amendment to the new bill, however, vested all administration in the President, who, of course, may detail that power to any official he may choose. Already the Department of Labor has a large housing organization.

An interestng amendment written into the law provides that "houses erected by the government under the authority of this act shall be of only a temporary character, except where the interest of the government will be best preserved by the erection of buildings of a permanent character."

Clamer Nominated for President of Testing Materials Society

G. H. Clamer, of the Ajax Metals Co., Philadelphia, has been nominated for president of the American Society for Testing Materials by the regular nominating committee. The rest of the ticket includes George S. Webster, director of wharves, docks and ferries, Philadelphia, as vice-president, and G. Aertzen of the Midvale Steel Co., G. K. Burgess of the Bureau of Standards, G. B. Heckel, editor of *Drugs, Oils and Paints*, and K. W. Zimmerschied of the General Motors Co., as directors. The annual meeting is to be held at the Hotel Traymore, Atlantic City, N. J., June 25-28, and will include a joint session with the American Concrete Institute meeting at the same place June 27-29.

New Plan to Finance Canadian Government Railways

The Dominion Parliament at Ottawa has considered a recommendation made by the Minister of Railways, providing that in future the expenses of the Canadian Government Railways and of all of the railways under the management of the Minister of Railways should be paid out of the receipts and revenues of the various lines involved. In the event of a deficit, the recommendation provides that this shall be paid out of any unappropriated moneys still in the consolidated revenue fund, to be subsequently covered by a vote of Parliament.

Railroads Permitted to Support Engineering Association

Authority has been granted to the American Railway Engineering Assosiation to make assessments on the railroads for current expenses of the association. Approval of the status of the association up to Apr. 30 had been granted by the Director-General of Railroads. Application for permanent approval was made in March. A letter had been received by the association from C. A. Prouty director of the division of public service and accounting of the railroad administration, authorizing the carriers to pay assessments made by the association, charging them to operating expenses.

Will Design and Operate Test Filter Plant

The experimental water-filtration and disinfection plant for Milwaukee, noted in *Engineering News-Record* of Apr. 11, p. 738, will be designed by Joseph W. Ellms, consulting engineer, Cincinnati, and the experiments will be conducted under his direction. Funds to the amount of $30,000 have been provided.

Sanitary Engineer Appointed To Fight Malaria at Camp Bowie

The U. S. Public Health Service has detailed J. A. Le Prince, one of its sanitary engineers, for anti-malarial work in the Camp Bowie zone, near Fort Worth, Tex. Mr. Le Prince had extensive experience in mosquito suppression and the prevention of disease caused by these pests, in the Panama Canal Zone.

ENGINEERING SOCIETIES

E. S. Carman, chief engineer, Cleveland Osborn Mfg. Co., Cleveland, addressed the Cleveland Engineering Society, at its Apr. 30 meeting, on "The Engineer, Manufacturer and Foundryman Coöperating to Conserve Man Power." The meeting of May 7 was addressed by O. W. A. Oetting, sales engineer, Willard Storage Battery Co., Cleveland. The society, on May 14, will be addressed by A. L. Feild, former assistant metallurgist, Bureau of Mines, Pittsburgh. His subject will be "High Temperature Research, with Special Reference to Metallurgical Problems."

The Detroit Engineering Society elected the following officers at its annual meeting Apr. 27: President, Charles

Calendar

Annual Meetings

AMERICAN WATER-WORKS ASSOCIATION; 47 State St., Troy, N. Y.; May 13-18, St. Louis, Mo.

AMERICAN ASSOCIATION OF ENGINEERS; 29 South La Salle St., Chicago; May 14, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS; 29 West 39th St., New York; Spring meeting, June 4-7, Worcester, Mass.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS; 129 York St., Brooklyn, N. Y.; June 19-22, Berlin, N. H.

AMERICAN CONCRETE INSTITUTE; 27 School St., Boston; June 24-26, Atlantic City, N. J.

AMERICAN SOCIETY FOR TESTING MATERIALS; University of Pennsylvania, Philadelphia; June 25-28, Atlantic City, N. J.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS; 29 West 39th St., New York; Atlantic City, June 26-28.

Y. Dixon; vice presidents, D. J. Sterrett and F. H. Davis; secretary-treasurer, D. V. Williamson. Col. W. G. Caples, 310th Engineers, National Army, spoke on what engineers have done in the war. Capt. Robert Laussel, reserve engineer, French Army, spoke on the destruction of trenches by the use of mines.

The New Jersey Association of County Engineers discussed the subject of "return loads" in connection with motor-truck hauling, at a special meeting held Apr. 29 at the Engineers' Club of Trenton. A "return loads" committee was appointed by the president of the County Engineers' Association, with Garwood Ferguson, Passaic County, as chairman.

The Engineering Club of Des Moines, Iowa, has been formed, with a membership including practicing engineers, graduate engineers who may have entered other work, and nongraduates who have engaged in engineering work. The officers of the club are A. W. Lee, president; R. H. Kinnaird, vice-president, and Monroe L. Patzig, secretary.

The Detroit Engineering Society was addressed May 3 by Robert H. Kuss, consulting engineer, Chicago, on the subject of "Coal Conservation as Applied to Boiler Room Operation." The meeting was held jointly with the **Detroit section of the American Society of Mechanical Engineers.**

The Engineers' Club of Trenton will be addressed at its meeting tonight by J. B. Scott, of Day & Zimmerman, Inc., on the new power plant of the Erie Lighting Co., Erie, Penn.

The Brooklyn Engineers' Club will hold its next regular meeting tonight. James E. Gibbons will read a paper entitled "The Story of Camp Jackson at Columbia, S. C." The May 16 meeting will be addressed by William J. Barney on "The Port of New York and Pier Construction." At the meeting of May 23 Eskill Berg will speak on "Recent Developments in Propelling Machinery for Warships and for Ships in Merchant Service."

The West Virginia University Engineering Society held its last regularly scheduled meeting for this semester May 3. The papers read and discussed related mainly to subjects connected with electric engineering.

The Engineers' Club of Columbus, Ohio, elected the following officers Apr. 26: E. G. Bradbury, president; D. G. Morris, secretary. The meeting was addressed by Prof. H. J. Lord of Ohio State University on the "Theory of Flight."

PERSONAL NOTES

J. G. BLOOM has been appointed division engineer of the Chicago, Rock Island & Pacific Ry., with headquarters at Harrington, Kan.

COL. C. N. MONSARRAT, chairman of the board of engineers, Quebec Bridge, has been appointed consulting engineer to the railways department of the Canadian Government. The offices of the board of engineers will be removed from Montreal to Ottawa, where its work will be terminated.

DR. ROBERT H. WHITTEN, formerly secretary of the city plan commission of New York City, has been appointed consulting engineer to the city plan commission of Cleveland. F. R. Walker will act as assistant to Mr. Whitten.

C. V. R. FULLENWIDER has become engineer in charge of construction work at the Syracuse plant of the Semet-Solvay Co. Mr. Fullenwider has been employed in the engineering department of the company for the past five years.

HILLIS F. HACKEDORN, president of the Hackedorn Contracting Co., Indianapolis, has been commissioned major in the construction division of the Quartermaster Corps, National Army.

H. E. SQUIRE, assistant engineer, California State Board of Harbor Commissioners, has been called to Washington to assist R. J. Wig, of the United States Shipping Board, who is giving special attention to the concrete ship division. During the past 14 months in which Mr. Squire has been at San Francisco, he has had charge of the investigation relative to the effect of sea water on concrete being carried out under the direction of Frank G. White, chief engineer of the Harbor Commission.

THOMAS A. BALDWIN, assistant to the superintendent of the erection department of the Bethlehem Steel Bridge Corporation, Steelton plant, has been commissioned senior lieutenant in the United States Navy.

N. MAX DUNNING, president of the Illinois Chapter, American Institute of Architects, has been appointed principal assistant to the chief of the bureau of housing, Department of Labor, Washington, D. C.

W. H. DURBIN has resigned as engineer for the Department of Public Sanitation, Indianapolis, to become a member of the staff of engineers of the Industrial Bureau of Housing, Washington, D. C.

SUMMERS HINSHAW has resigned as chief engineer of the Knoxville Water Co. to become chief engineer of the Fulton Co., Knoxville, Tenn.

GUY PINNER, who recently resigned as bridge engineer of the Seaboard Air Line Ry., is now associated with James Stewart & Co., contractors.

CARL W. HAEFNER, formerly of the Turner Construction Co., New York, has become associated with Fay, Spofford & Thorndike, consulting engineers, Boston, as engineer in charge of lines and grades on the construction of the new Government shipping terminal at South Boston.

FRED S. SAWYER, of the firm of Sawyer Bros., engineers, Spokane, Wash., has gone to Columbus, Ohio, to become construction engineer for the Government on its $5,000,000 warehouse project.

L. H. MOTH, who has been connected with the water-works department, Kenosha, Wis., for the past eleven years, has been made superintendent of the water-works department of Jackson, Mich.

HARRY A. WHARTENBY, formerly of the Virginia Bridge & Iron Co., Roanoke, Va., has become chief draftsman of the American Steel Co. of Cuba, with headquarters at Havana.

LAURENCE A. BALL, formerly chief engineer of the Richard Carvel Co., Inc., has been retained as consulting engineer for Jersey City, in charge of the construction of the new water-pipe line to be laid across the Hackensack and Passaic Rivers.

OBITUARY

WILLIAM H. BARNES, director of the Pennsylvania R.R., died in Philadelphia, May 6. Mr. Barnes, who was 89 years old, entered the service of the Pennsylvania in 1848, in the engineering department, which was then engaged in making the location surveys for the road west of the Alleghenies, at Greensburg, Penn. Mr. Barnes had been a director of the Pennsylvania since 1889.

American Industrial Exhibits at Lyons Fair

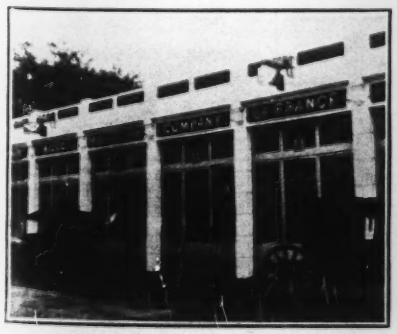
War Correspondent of Engineering News-Record Reports Many Interesting Features

American manufacturers were represented by 543 exhibits at the third Lyons Fair, held this spring in Lyons, France. An interesting report of this war-time industrial fair has just been received from R. K. Tomlin, Jr., war correspondent of *Engineering News-Record* and Paris representative of the McGraw-Hill engineering publications. Mr. Tomlin reports that this year, as formerly, the fair covered a wide range of industry — practically everything from the making of silk to the manufacture of huge artillery, field pieces, shells and aërial bombs. The official figures indicated the participation of more than 3000 exhibitors, the greatest number that has ever taken part in this exposition.

Importance of Fair to American Manufacturers

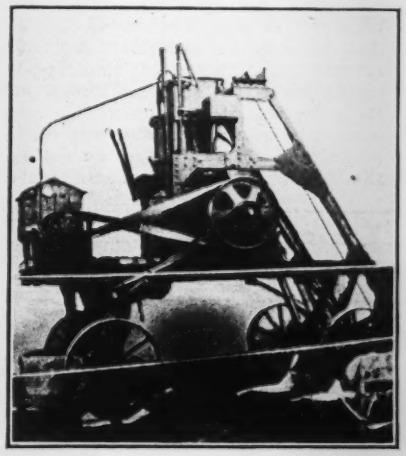
The possible importance of the Lyons Fairs to American manufacturers is illustrated by the following quotation taken from a statement made by W. A. Veditz, commercial attaché of the American embassy at Paris:

"The extraordinary success of the Lyons Fair in 1916 and 1917 is a striking proof of the economic vitality of France, as well as the capacity for organization of its statesmen and commercial agents. Whilst it is not for me to proffer advice to the officials in charge of the Lyons fair I am strongly of opinion that the importance of the fair should be brought home strikingly to American importers and exporters. Also I am of opinion that such commercial organizations as the Lyons fair would stimulate Franco-American trade to an enormous extent. The latter consideration will apply to a greater extent when international commerce resumes its normal aspect. I am of opinion that, with regard to American trade, and the establishment of institutions dealing with economical as well as commercial interests, nothing would be welcomed more than the Lyons fair, especially if it should ultimately develop into a great international sample fair of Europe."



AMERICAN MANUFACTURERS' BOOTHS

This statement, together with the comparative shortage of construction equipment exhibits at the fair (illustrated by the fact that there was only one concrete mixer shown in the entire exposition) appears to indicate that manufacturers of American engineering and industrial equipment will be more extensively represented at the fair next year, in view of a greater possibility of the return of normal business conditions in France.



ONLY CONCRETE MIXER EXHIBITED

Expressions of opinion from the administrative headquarters of the fair were to the effect that its results presage a partial, if not total, eclipse of German efforts at foreign trade expansion through the instrumentality of the Leipsic fair. It was confidently reported that the "Foire de Lyon" has been established as a permanent international trade institution, and that its birth three years ago and rapid growth since that time has caused a great deal of uneasiness in official and industrial circles in Germany.

On the opening day of the fair, the official count of exhibitors was 3176. Of this number, 860 were foreign, classified as follows: United States, 543; Switzerland, 114; Great Britain, 107; Italy, 40; Spain, 33; Holland, 22; Russia, 1. Without an explanation these figures are somewhat misleading in so far as they concern American exhibits, since there were not 543 American firms which actually had booths at the fair. The American consulate at Lyons, however, had an exhibit which consisted largely of catalogs of American manufacturers, and, according to a statement made to *Engineering News-Record's* representative at the executive offices of the fair, each firm that had a catalog on file with the American consul was called an exhibitor.

Engineering News-Record Represented

For the first time in the history of the fair a publisher of American engineering journals was an exhibitor, the McGraw-Hill Co., Inc., of New York City, publisher of *Engineering News-Record* and nine other technical journals, having a stand in the Place Bellecour.

The crippled transportation facilities in France made themselves felt at the fair, as very few of the exhibits were complete on the opening day. This applied particularly to the stands of foreign exhibitors. The McGraw-Hill Co., for example, had shipped a case of its journals from New York. The case arrived at Bordeaux, was held there and was not delivered until the last day of the fair. For American firms intending to exhibit at future fairs in Lyons it would be well to take this example to heart, and to make all preparations far in advance of the date of opening the exposition.

THE McGRAW-HILL EXHIBIT

Of construction plant there were very few exhibits, as this is not a period of general engineering construction in

France, and all industry, practically, is engaged in some form of war work—principally on munitions and ordnance. There were, however, exhibits of pneumatic tools and valves, etc., excavating tools, air compressors and motor-driven pumps. The accompanying illustration shows the only concrete mixer exhibited.

Among the remaining exhibits in the civil engineering and construction field were those consisting of the following: Transits and levels, hollow-tile flooring, I-beams and rails, railroad and tramway material, pumps and compressors, autogenous welding, metallic paints, belt conveyors and chains, valves, centrifugal pumps, small rock crushers, cranes and steel construction, industrial cars and narrow-gage track, asphalt products and hydraulic machinery of various types.

From the point of view of technical men the fair was largely a machine-tool exhibit. In the metallurgy booth were machine tools and other equipment used in the manufacture of munitions and ordnance. A few American manufacturers had individual stands, although their products were on display at the stands of French companies acting as their agents or in various other special capacities. However, the Allied Machinery Co. of France, a subsidiary of the Allied Construction Machinery Co., New York, had a four-compartment stand which contained the exhibits of five prominent American machine-tool and tool manufacturers. The firm, Anc. Etab. Glaezer & Pirreaud, Paris, represented and handled the exhibit of a number of American machine-tool manufacturers. American electrical equipment was also exhibited.

Ordnance and Motor Trucks

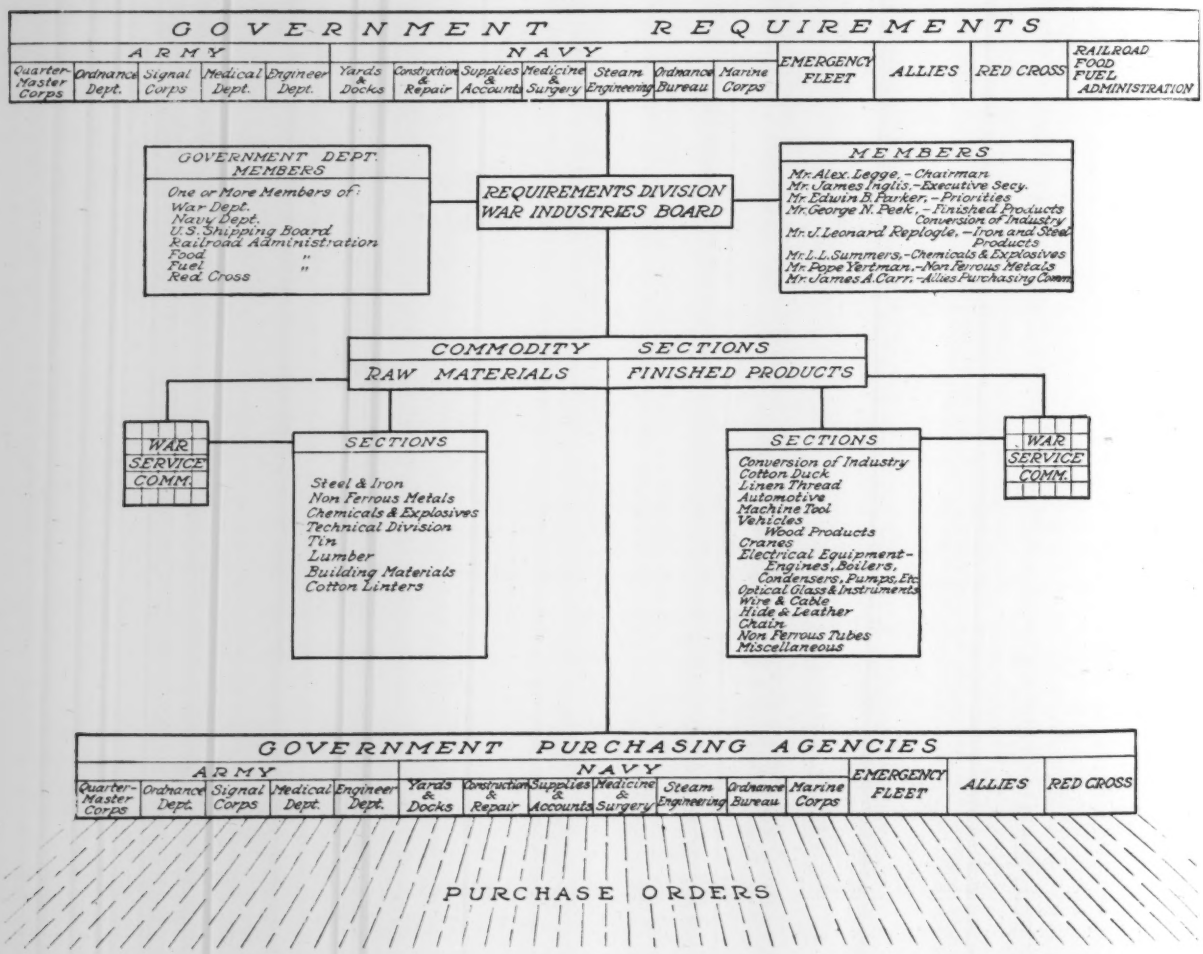
One of the biggest and most impressive exhibits was that of Schneider & Compagnie, Paris, as showing the important part which industries have played in the war. Here munitions and ordnance manufacture was exhibited, although the company is engaged in producing a multitude of other things, including motor trucks, locomotives, tractors and, in fact, mechanical equipment and machinery of all types, in addition to ships.

The motor-truck and automobile exhibit attracted particular interest. Many of the exhibitors are making *camions* for the Allied armies. Notable among these was the big chassis of Ch. Blum & Cie., equipped with a Latil engine and drive on all four wheels, the steering gear controlling both front and rear wheels.

Organization for Industrial War Requirements

The chart shown below outlines the organization of the requirements division of the War Industries Board for procuring the enormous quantities of materials and supplies needed in the war and in converting industries from non-war to war purposes.

In the operation of filling requirements for war purposes it is stated that each section chief is charged with the responsibility of collecting from the several departments of the Government, from the manufacturers and from the committees representing them, and especially from the war-service committees created under the supervision of the Chamber of Commerce of the United States and from any other reliable and available sources, information concerning the production of the particular commodity or commodities with which each section has to deal, including available supplies, new sources of supply and methods for increasing production. The various government purchasing agencies will continue to make the contracts and place orders.



Labor Turnover Wasting 20% of Effective Supply

Roger W. Babson Urges Greater Use of United States Employment Service as Remedy

If the labor turnover in this country could be eliminated, the effective labor supply would be increased about 20%, according to a statement made before the Baltimore Advertising Club by Roger W. Babson, chief of the inquiry and education division of the United States Employment Service. The use by employers of the United States Employment Service, he said, would be the first and most effective step toward reducing the turnover.

In support of an assertion that there is sufficient labor available in the United States if it is properly distributed, Mr. Babson read reports received by the Employment Service of idle and empty houses in many sections of the country. He advocated the granting of half fares by the railroad administration to men transported from one section to another through the agency of the Employment Service. Such a step, he declared, would certainly facilitate the work of labor distribution.

"The great need of the hour," said Mr. Babson, "is to extend the United States Employment Service in order to redistribute labor and make idle labor immediately available. England has more than 2000 Government employment offices, while our country, so many times larger than England, has little more than one-tenth that number. England's success in handling her labor problem has been due in a large measure to her efficient and impartial national employment service, which, under the terms of the munitions of war acts, practically controls the employment situation. Her manufacturers and others engaged in Government work can obtain labor only through the Government's labor exchanges. This prevents one department or concern from bidding against another and insures fairness and impartiality to all.

Will Reduce Turnover

"By the extension of the United States Employment Service and the adoption of a similar procedure, the tremendous labor turnover which we now have would be greatly reduced. The elimination of the turnover in this country would be equivalent to increasing the available labor supply about 20 per cent."

Discussing the transportation question, Mr. Babson continued:

Lower Fare to Workers

"Now that the railroads are under Government control for the period of the war, there is a great opportunity offered to facilitate labor distribution by reducing rates to workers transported through the United States Employment Service, particularly farm workers. The housing problem is now on the road to satisfactory solution, but the transportation problem is still unsolved. The United States Employment Service now has a $250,000 revolving fund for the advancement of transportation costs to wage earners, but it is insufficient to meet all demands. Furthermore, many a worker now requiring advancement of carfare would be able to pay his own transportation were the rate to him reduced one-half. If the United States Railroad Administration would grant half fares to men transferred by the Employment Service, a great improvement in the labor situation would immediately be evident.

Helps All Sections

"The United States Employment Service is interested in the country as a whole; it favors no particular section. It is bringing about a readjustment along the minor lines of labor shortage and surplus, eliminating surpluses as well as shortages. For this reason the Employment Service is as much interested in helping the localities in which there are surpluses of labor and houses as it is in obtaining labor for communities which have a surplus of contracts."

Business Notes

The Lakewood Engineering Co. has been authorized to increase its capital stock from $300,000 to $1,100,000 for the purpose of purchasing several additional plants. It is understood that the company contemplates the outright purchase of the Dynamic Motor Truck Co., Galion, Ohio, and a foundry at Elyria, as well as a large interest in the Milwaukee Concrete Mixer Company.

The Asbestos Protected Metal Co., Pittsburgh, has changed its name to the Aspromet Co. When the company was established in 1905 its sole product was asbestos protected metal, to which other building material specialties were added.

The board of directors of the Trumbull Steel Co., Youngstown, Ohio, has recommended to the stockholders an increase in the capital stock of $8,000,000, which would make a total of $20,000,000. The question will be put to the stockholders' meeting to be held May 17.

The Controller Co., Inc., has taken over the Oscar Muller Co., manufacturers of the "Controller" calculating machine.

The Sullivan Machinery Co. has changed its Lake Superior sales office from Ishpeming, Mich., to Duluth, Minn. Jonathan A. Noyes will be in charge as district manager.

The offices of the National Meter Co. have been removed to 299 Broadway, New York City. As merchandise cannot be received at this address, it should be shipped to the works of the company at 42nd St. and 1st Ave., Brooklyn.

The Luitwieler Pumping Engine Co., of Rochester, N. Y., has opened an office in Chicago, in charge of T. M. Weinstein, a factory representative of the company.

R. F. Valentine, previously sales manager of the Sawyer Belting Co., Cleveland, has become sales manager of the United Brass Manufacturing Co., Cleveland.

A. T. Smith, lately manager of the R. U. V. Co., of New York City, has returned to the Permutit Co. as assistant manager of sales.

Trade Publications

"Combination in Export Trade Under the Webb Law" is the title of a new 28-page booklet published by the Guaranty Trust Co., New York.

"Universal Pipe for Every Service" is the title of a new leaflet published by the Central Foundry Co. The leaflet contains illustrated descriptions of the uses of various classes of pipe under different conditions.

The Wheeler Condenser & Engineering Co. has issued the fourth edition of its handbook, entitled "Steam Tables for Condenser Work." An interesting feature of the handbook is that the pressures below atmosphere are expressed in inches of mercury, referred to a 30-in. barometer.

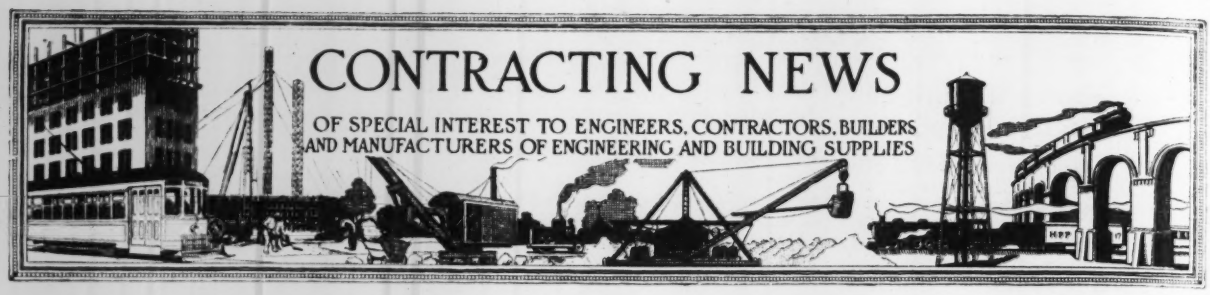
The General Fireproofing Co., Youngstown, Ohio, has issued a 16-page illustrated booklet describing the uses of "Trussit," a corrugated expanded sheet forming the base and reinforcement for factory walls and partitions.

The Electric Machinery Co., Minneapolis, has issued a 22-page bulletin describing the use of synchronous motors for driving pumping machinery.

Catalog No. 18, illustrating "Boss" concrete machinery, has been released by the American Cement Machine Co., Inc. It contains 39 pages of illustrated description of the various types and uses of concrete and cement machinery and equipment.

The Geo. Haiss Mfg. Co. has issued a seven-page illustrated leaflet describing the Haiss self-feeding wagon loaders.

The Wilson Welder Metals Co., Inc., New York, has produced a handsomely illustrated 45-page booklet on electric welding, which contains numerous descriptions of Wilson electric welding outfits and devices.


CONTRACTING NEWS
OF SPECIAL INTEREST TO ENGINEERS, CONTRACTORS, BUILDERS
AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES

Proposals

For Proposals Advertised See Pages 93-97 Inclusive

WATER-WORKS

Bids Close		See Eng. News-Record
May 10	West Haverstraw, N. Y. Adv. May 2.	May 2
May 22	Chicoutimi, Que.	Apr. 25

SEWERS

May 10	Brooklyn, N. Y.	May 9
May 13	Jewell, Ia.	May 2
May 13	Fond du Lac, Wis.	May 9
May 13	Waukegan, Ill.	May 9
May 14	Wichita, Kan.	May 9
May 15	Franklin, Wis.	May 2
May 15	Ft. Smith, Ark.	May 2
May 15	West View, Pa.	May 2
May 16	Brainerd, Minn.	Apr. 25
May 18	Martinsburg, W. Va.	Apr. 25
May 21	Columbus, O.	May 9
May 21	Kings Park, N. Y.	May 2
May 29	Shelbyville, Ky.	May 9
June 6	Chicago, Ill. Adv. May 9.	May 2

BRIDGES

May 14	Milton, Fla.	Apr. 25
May 14	Modesto, Cal.	Apr. 25
May 15	Iron Mountain, Mich.	May [illegible]
May 15	Yarmouth, Me.	May 9
May 16	Somerville, N. J.	May 9
May 16	Harrisburg, Pa.	Apr. 25
May 20	Charleston W. Va.	Apr. 18
May 20	Rodeo, Cal.	May 9
May 20	Hobart, Okla.	May 9
May 23	Linton, N. D.	May 9
May 27	Uniontown, Pa.	May 9
June 1	Forsyth, Mo.	May 2
June 1	Ada, Okla.	May 2

STREETS AND ROADS

May 13	Louisiana	Apr. 25
May 13	Tennessee	Apr. 25
May 13	East Chicago, Ind.	May 2
May 13	Kansas City, Kan.	May 2
May 13	Sayre, Pa.	May 2
May 13	Freehold, N. J. Adv. May 2.	May 2
May 14	Buffalo, N. Y.	May 9
May 14	Chaska, Minn.	Apr. 25
May 14	Jersey City, N. J.	May 9
May 14	Owatonna, Minn.	May 9
May 14	Pensacola, Fla.	Apr. 25
May 14	Michigan	May 9
May 15	Eau Claire, Wis.	May 9
May 15	Delaware Adv. Apr. 25 and May 2.	
May 15	Rhode Island	May 9
May 15	Wabasha, Minn.	May 2
May 16	Madison, Wis.	May 2
May 16	Stillwater, Minn.	Apr. 25
May 17	Red Wing, Minn.	May 9
May 18	Indiana	May 2
May 20	Everett, Wash.	May 9
May 20	Seattle, Wash.	May 2
May 21	Buffalo, N. Y.	May 9
May 21	Tuscaloosa, Ala.	May 2
May 22	Florence, Ala.	May 9
May 24	Jonesboro, Ark. Adv. May 2.	May 2
May 24	Uniontown, Pa.	May 9
May 27	Mt. Vernon, Wash.	May 9
June 1	Oswego, Kan.	Mar. 28
June 6	Jefferson City, Mo.	May 2
Aug. 1	Cleveland, O.	Mar. 28

EXCAVATION AND DREDGING

May 10	Lawrence, Mass.	May 9
May 13	Greenville, Miss. Adv. Apr. 18 and May 2.	Apr. 18
May 14	Trenton, N. J.	May 2
May 15	Chillicothe, Mo.	Apr. 25
May 17	Coeur D'Alene, Idaho.	May 9
May 23	Greenville, Miss.	Apr. 18
June 4	Albany, N. Y.	May 9

INDUSTRIAL WORKS

May 15	Eau Claire, Wis.	May 2
May 15	Buffalo, N. Y.	May 2
May 15	Milwaukee, Wis.	May 2
Oct. 15	Poteau, Okla.	May 9
May 18	Cleveland, O.	Apr. 18
May 25	Zanesville, O.	May 9

BUILDINGS

May 13	Darien, Conn.	May 9
May 13	Superior, Wis.	Apr. 18
May 13	Lincoln, Neb.	May 2
May 14	Zanesville, O.	May 2
May 14	Hastings, Minn.	May 9
May 15	Jersey City, N. J.	Apr. 18
May 15	Helena, Mont.	May 9
May 15	Hempstead, L. I., N. Y.	May 2
May 15	Miami, Okla.	May 9
May 15	Alexandria, La.	May 2
June 15	Phila., Pa.	Mar. 28
May 16	Herkimer, N. Y.	Apr. 25
May 16	Pewaukee, Wis.	May 2
May 16	Viborg, S. D.	May 9
May 17	Washington, Ia.	Apr. 25
May 20	Clintonville, Wis.	May 9
May 20	Ceylon, Minn.	May 2
May 20	Port Edward, Wis.	May 2
May 20	South Amboy, N. J.	May 9
May 21	Taylor Falls, Minn.	May 2
May 22	Clarksdale, Miss.	May 9
May 23	Story, Ia.	May 2
May 27	Bagee, Miss.	May 9
May 27	Wellsville, O.	May 9
May 27	Wishek, N. D.	May 9
May 28	Union Grove, Wis.	May 2
May 30	Medicine Lake, S. D.	May 9
May 30	Princeton, Minn.	May 2
June 1	Detroit, Mich.	May 2
June 3	Rockport, Ind.	May 2

FEDERAL GOVERNMENT WORK

May 13	Barracks—Pensacola, Fla.	May 9
May 13	Air Compressor—Philadelphia, Pa.	May 9
May 13	Concrete Reservoir and Pump Well—Yorktown, Va.	May 9
May 13	Power Plant—Washington, D. C.	May 9
May 13	Power Plant Improvements—Boston Mass.	Apr. 25
May 13	Radial Brick Chimney—Philadelphia, Pa.	Apr. 25
May 13	Wiring—Norfolk, Va.	May 9
May 13	Sea Wall—Washington, D. C.	May 9
May 13	Crane—New York, N. Y.	May 9
May 13	Mechanics School—Washington, D. C.	May 9
May 14	Armory—Washington, D. C.	Apr. 25
May 20	Wharf and Trestle—Charleston, S. C.	
May 20	Employees Quarters No. 112—Klamath, Ore.	May 9
May 20	Nurses Quarters—Great Lakes, Ill.	May 9
May 20	Levee Work—Vicksburg, Miss.	May 9
May 20	Electric Lighting Plant—Washington, D. C.	May 9
May 20	Addition to Clothing Factory, Charleston, S. C.	May 9
May 20	Automatic Telephone System—Washington(D. C.	May 9
May 20	Electric Lighting System—Philadelphia, Pa.	May 9
May 20	Elevator—Mare Island, Cal. (Vallejo P. O.)	May 9
May 20	Magazine, Washington, D. C.	May 9
May 20	New and Additional Storehouses—Boston, Mass.	May 9
May 20	Radial Block Chimney—Norfolk, Va.	May 9
May 20	Revetment-Detroit, Mich. Adv. May 2.	May 2
May 20	Wooden Pier, Railroad Track and Storage Shed—New London, Conn.	May 9
May 21	Culvert-Washington, D. C.	May 9
May 21	Levee Work, St. Louis, Mo. Adv. May 2.	May 2
May 25	Heating System—Phoenix, Ariz.	May 9
May 27	Buildings, Buffalo, N. Y. Adv. May 2.	May 2
May 27	Commandants' Quarters, etc.—San Diego, Cal.	May 9
May 27	Electric Duct System—Washington, D. C.	May 9
May 27	Wharf—Boston, Mass.	May 9
May 27	Revetment—Kansas City, Mo.	May 9
May 27	Buildings—Washington, D. C.	May 9
May 30	Dispensary — Puget Sound (Bremerton P.O.), Wash.	Apr. 25

MISCELLANEOUS

May 21	Column Foundation—Brooklyn, N. Y.	May 9